Opasraportti

FTech - Industrial Engineering and Management (2020 - 2021)

University’s new study guide for academic year 2020-2021 is published at https://opas.peppi.oulu.fi

The study guide includes information on degrees, curriculums, courses and course timetables. Course registrations are still done in Oodi.

If you have questions on information in the study guide, please contact the study field's Academic Affairs Service Team https://www.oulu.fi/forstudents/faculty-study-affairs

Tutkintorakenteet

Bachelor of Science in Technology, Industrial Engineering and Management

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

BASIC AND INTERMEDIATE STUDIES (vähintään 120 op)

- Choose the language in which you have a long high school course curriculum.
- Choose 2nd domestic language

555207M: Basic Studies in other Universities/ Institutes, 0 - 30 op
A440120: Basic and Intermediate Studies, Industrial Engineering and Management, 119,5 - 120 op

STUDY AND COMMUNICATION SKILLS

555203P: Study Skills, 2 op
030005P: Information Skills, 1 op
900061A: Scientific Communication for Production Engineering and Management, 2 op
900062P: Communicative Oral Skills for Production Engineering and Management, 2 op

CHOOSE ONE

901044Y: Second Official Language (Swedish), Written Skills, 1 op
901045Y: Second Official Language (Swedish), Oral Skills, 1 op

MATHEMATICS

031010P: Calculus I, 5 op
031078P: Matrix Algebra, 5 op
031075P: Calculus II, 5 op
031076P: Differential Equations, 5 op
031021P: Probability and Mathematical Statistics, 5 op

PHYSICS
ENGINEERING STUDIES (vähintään 40 op)

Electrical Engineering

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op
A440149: Module Preparing for the Major, Electronics and Communications Engineering, 40 op

Common studies
- 521109A: Electrical Measurement Principles, 5 op
- 521302A: Circuit Theory 1, 5 op
- 521301A: Digital Techniques 1, 8 op

Electronics
- 521077P: Introduction to Electronics, 5 op
- 521104P: Introduction to Material Physics, 5 op
- 521071A: Principles of Semiconductor Devices, 5 op
- 521431A: Principles of Electronics Design, 5 op
- 521303A: Circuit Theory 2, 5 op

Wireless Communication
- 031077P: Complex analysis, 5 op
- 031080A: Signal Analysis, 5 op
- 521330A: Telecommunication Engineering, 5 op
- 521329A: Hands-on Course in Wireless Communication, 5 op
- 521337A: Digital Filters, 5 op

Biomedical Engineering (Previous Medical and Wellness Technology)

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op
A440146: Module Preparing for the Major, Medical and Wellness Technology, 40 op

Biomedical Engineering
- 080901A: Introduction to Technology in Clinical Medicine, 5 op
- 764163P: Introduction to Biomedical Physics, 5 op
- 521109A: Electrical Measurement Principles, 5 op
- 080925A: Anatomy and Physiology for Biomedical Engineering, 5 op
- 031077P: Complex analysis, 5 op
- 031080A: Signal Analysis, 5 op
- 041201A: Basics in eHealth, 5 op
- 521124S: Electronic Sensors, 5 op

Software Engineering

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op
A440147: Module Preparing for the Major, Software Engineering, 40 op

**Common studies:** 521145A or 811177P
- 521145A: Human-Computer Interaction, 5 op
- 811177P: Humans as Users and Developers of Information Technology, 5 op
- 812363A: Human-Centred Design, 5 op

**Common studies**
- 811379A: Basics of Human Computer Interaction, 5 op
- 811168P: Information Security, 5 op
- 811391A: Requirements Engineering, 5 op

**Common:** 521457A tai 811346A
- 521457A: Software Engineering, 5 op
- 811346A: Software Engineering, 5 op

**Software production**
- 811174P: Introduction to Software Business, 5 op
- 811104P: Programming 1, 5 op

**Information Systems**
- 811167P: Introduction to Information Systems Design, 5 op
- 811166P: Fundamentals to Information Systems, 5 op
- 815345A: Software Architectures, 5 op
- 811325A: Databases, 5 op

**Information Engineering**

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

A440148: Module Preparing for the Major, Information Engineering, 40 op

**Common Studies**
- 521160P: Introduction to Artificial Intelligence, 5 op
- 521287A: Introduction to Computer Systems, 5 op

**Artificial Intelligence**
- 805305A: Introduction to Regression and Analysis of Variance, 5 op
- 521495A: Artificial Intelligence, 5 op
- 811325A: Databases, 5 op
- 521157A: Introduction to Social Network Analysis, 5 op
- 811312A: Data Structures and Algorithms, 5 op
- 031025A: Introduction to Optimization, 5 op

**Computer Science**
- 521145A: Human-Computer Interaction, 5 op
- 810122P: Computer Architecture, 5 op
- 521301A: Digital Techniques 1, 8 op
- 521150A: Introduction to Internet, 5 op
- 521159P: Principles of Digital Fabrication, 5 op
- 521337A: Digital Filters, 5 op

**Mining Technology and Mineral Processing**

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

A440145: Module Preparing for the Major, Mining Technology and Mineral Processing, 40 op

**Electives**
- 491101P: Introduction to mining, 5 op
- 477121A: Particle Technology, 5 op
- 477122A: Bulk Solids Handling, 5 op
- 477401A: Thermodynamic Equilibria, 5 op
- 477221A: Material and Energy Balances, 5 op
- 771113P: Introduction to Geology I, 5 op
- 771117P: Basic course in mineralogy, 5 op
- 774311A: A Basic Course in Geochemistry, 5 op

**Mechanical Engineering**

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

A440141: Module Preparing for the Major, Mechanical Engineering, 40 op

**Common Studies**
- 464101A: Machine drawing and CAD, 5 op
465101A: Introduction to materials for mechanical engineering, 5 op
463101A: Introduction to manufacturing technology, 5 op

Machine Design
461102A: Statics, 5 op
461103A: Strength of materials I, 5 op
464102A: Design of machine elements, 10 op
464103A: Machine design, 5 op

Mechatronics
462104A: Machine automation, 5 op
462105A: Machine Sensor Technology, 5 op
462106A: Precision engineering, 5 op
521301A: Digital Techniques I, 8 op
462108S: Mechatronics, 6 op

Production engineering
463102A: Manufacturing technology I, 5 op
521159P: Principles of Digital Fabrication, 5 op

Process Engineering
555205M: Engineering studies in other Universities/Institutes, 0 - 30 op
A440143: Module Preparing for the Major, Process Engineering, 40 op

Common studies
477013P: Introduction to Process and Environmental Engineering, 5 op
477052A: Fluid Mechanics, 5 op
477401A: Thermodynamic Equilibria, 5 op
477221A: Material and Energy Balances, 5 op
477323A: Mass and Heat Transfer, 5 op

Process engineering
477121A: Particle Technology, 5 op
477122A: Bulk Solids Handling, 5 op
477222A: Reactor Analysis, 5 op

Automation engineering
477051A: Automation Engineering, 5 op
477502A: Experiment design and analysis, 5 op
477501A: Process dynamics, 5 op

Civil Engineering
555205M: Engineering studies in other Universities/Institutes, 0 - 30 op
A440142: Module Preparing for the Major, Civil Engineering, 40 op

Electives
485201A: Building information modeling and CAD, 5 op
461102A: Statics, 5 op
461103A: Strength of materials I, 5 op
485101A: Introduction to building construction, 5 op
466102A: Introduction to structural design, 3 - 5 op
485021A: Construction Contracting, 5 op
485301A: Basics of Geotechnics, 5 op
485103A: Building physics, 5 op

Environmental Engineering
555205M: Engineering studies in other Universities/Institutes, 0 - 30 op
A440144: Module Preparing for the Major, Environmental Engineering, 40 op

Electives
477013P: Introduction to Process and Environmental Engineering, 5 op
477401A: Thermodynamic Equilibria, 5 op
477052A: Fluid Mechanics, 5 op
477221A: Material and Energy Balances, 5 op
477323A: Mass and Heat Transfer, 5 op  
488102A: Hydrological Processes, 5 op  
488210A: Environmental science and technology, 5 op  
488505A: Waste management and recycling, 5 op

Other Engineering Studies

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op  
A400072: Module Preparing for the Option, 20 - 40 op

OPTIONAL STUDIES (enintään 10 op)

Optional Studies.

Choose the courses to get total of 180 ECTS to your degree.

555206M: Elective studies in other Universities/Institutes, 0 - 30 op  
A440171: Optional Studies, Bachelor of Science (Industrial Engineering and Management), 0 - 20 op  
IEM electives  
555214A: Working in the university community, 5 op  
555215A: Working life project, 5 op

BACHELOR'S THESIS AND RELATED STUDIES (vähintään 10 op)

555200A: Bachelor's Thesis / Industrial Engineering and Management, 8 op  
555201A: Bachelor's Thesis Seminar, 2 op  
555202A: Maturity Test / Bachelor of Science in Industrial Engineering and Management, 0 op

Master of Science in Technology, Industrial Engineering and Management/  
Product Management

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

MAJOR STUDIES: 40 ECTS cr (40 op)

555307M: Common Studies of the Majors in other Universities /Institutes, 0 - 30 op  
A440230: Major Studies, Product Management, 40 op  
Compulsory  
555313S: Management, 5 op  
555314S: Management Information Systems, 5 op  
555301S: Research Seminar, 5 op  
555304S: Advanced Internship, 5 op  
555305S: Research and Technology Management, 5 op  
555315S: Advanced Course in Product Development, 5 op  
555343S: Product Data and product life cycle management, 5 op  
555346S: Product portfolio management, 5 op

SUPPLEMENTARY MODULE 1: Supplementary studies, 20 ECTS cr (vähintään 20 op)

The total extent of the major studies and the supplementary module 1 should be at least 60 ECTS cr.
1. Select one of the modules 11 - 13. The instruction language in the module 13 is Finnish. The courses in a module are compulsory.

2. Fill the modules with other major's, other module's or elective advanced studies (the list is included in the modules) so that the total extend of the major studies is at least 60 ECTS cr.

**Module 11: Organisation and knowledge management**

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op
A440259: Complementary Study Module of the Major/ Organization and Knowledge management, Advanced Module, 10 op

*Obligatory studies of Organisation and knowledge management*
- 555370S: Strategic Management, 5 op
- 555371S: Human Resource Management, 5 op

*Elective advanced studies*
- 555377S: Risk Management, 5 op
- 555378S: Seminar in industrial engineering and management, 5 op
- 555379S: Research Project in Industrial Engineering and Management, 5 op

*Project Management*
- 555391S: Advanced Course in Project Management, 5 op
- 555382S: Management of a project-based firm, 5 op

*Process and Quality Management*
- 555390S: Process Analytics, 5 op
- 555389S: Systematic Process Improvement, 10 op

*Product Management*
- 555350S: Research and Technology Management, 5 op
- 555351S: Advanced Course in Product Development, 5 op
- 555343S: Product Data and product life cycle management, 5 op
- 555346S: Product portfolio management, 5 op

*Production Management*
- 555330S: Sourcing Management, 5 op
- 555331S: Advanced Supply Chain Management, 5 op
- 555332S: Operations and supply network analytics, 5 op
- 555333S: Production Management, 5 op

**Module 12: Project Management**

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op
A440260: Complementary Study Module of the Major/ Project Management, Advanced Module, 10 op

*Obligatory studies of Project Management*
- 555391S: Advanced Course in Project Management, 5 op
- 555382S: Management of a project-based firm, 5 op
- 555392S: Change Project and Programme Management, 5 op

*Elective advanced studies*
- 555376S: Sustainable organisational development, 5 op
- 555377S: Risk Management, 5 op
- 555378S: Seminar in industrial engineering and management, 5 op
- 555379S: Research Project in Industrial Engineering and Management, 5 op

*Organisation and knowledge management*
- 555370S: Strategic Management, 5 op
- 555371S: Human Resource Management, 5 op

*Process and Quality Management*
- 555390S: Process Analytics, 5 op
- 555389S: Systematic Process Improvement, 10 op

*Product Management*
- 555350S: Research and Technology Management, 5 op
- 555351S: Advanced Course in Product Development, 5 op
- 555343S: Product Data and product life cycle management, 5 op
- 555346S: Product portfolio management, 5 op

*Operations and supply network management*
- 555330S: Sourcing Management, 5 op
Module 13: Process and Quality Management

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op
A440261: Complementary Study Module of the Major/ Process and Quality Management, Advanced Module, 15 op

Obligatory studies of Process and Quality Management
555390S: Process Analytics, 5 op
555389S: Systematic Process Improvement, 10 op

Elective advanced studies
555376S: Sustainable organisational development, 5 op
555377S: Risk Management, 5 op
555378S: Seminar in industrial engineering and management, 5 op
555379S: Research Project in Industrial Engineering and Management, 5 op

Project Management
555391S: Advanced Course in Project Management, 5 op
555382S: Management of a project-based firm, 5 op

Organisation and knowledge management
555370S: Strategic Management, 5 op
555371S: Human Resource Management, 5 op

Production Management
555330S: Sourcing Management, 5 op
555331S: Advanced Supply Chain Management, 5 op
555332S: Operations and supply network analytics, 5 op
555333S: Production Management, 5 op

Product Management
555350S: Research and Technology Management, 5 op
555351S: Advanced Course in Product Development, 5 op
555343S: Product Data and product life cycle management, 5 op
555346S: Product portfolio management, 5 op

SUPPLEMENTARY MODULE 2: Engineering and other IEM studies, 20 ECTS cr (vähintään 20 op)

Master’s Programme student (2 year education) should select ‘other IEM’ studies.

Degree Programme student (5 year education) should select ‘engineering’ studies.

Other Industrial Engineering and Management Studies

A440270: Complementary Module, Other Industrial Engineering and Management Studies, 20 - 30 op

Elective studies (max 10 cr)
555226A: Operations and supply chain management, 5 op
555242A: Product development, 5 op
555285A: Project management, 5 op
555286A: Process and quality management, 5 op

Elective advanced studies
555377S: Risk Management, 5 op
555376S: Sustainable organisational development, 5 op
555378S: Seminar in industrial engineering and management, 5 op
555379S: Research Project in Industrial Engineering and Management, 5 op

Project Management
555391S: Advanced Course in Project Management, 5 op
555382S: Management of a project-based firm, 5 op

Organization and knowledge management
555370S: Strategic Management, 5 op
555371S: Human Resource Management, 5 op

Process and Quality Management
555390S: Process Analytics, 5 op
555389S: Systematic Process Improvement, 10 op
Product Management
555350S: Research and Technology Management, 5 op
555351S: Advanced Course in Product Development, 5 op
555343S: Product Data and product life cycle management, 5 op
555346S: Product portfolio management, 5 op

Production Management
555330S: Sourcing Management, 5 op
555331S: Advanced Supply Chain Management, 5 op
555332S: Operations and supply network analytics, 5 op
555333S: Production Management, 5 op

Electronics and Communications Engineering (previous Electrical Engineering)
555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440253: Supplementary Module, Electrical Engineering, 20 - 30 op

Electronics
521432A: Electronics Design I, 5 op
521070A: Introduction to Microfabrication Techniques, 5 op
521404A: Digital Techniques 2, 5 op
521307A: Laboratory Exercises on Analogue Electronics, 5 op
521075S: Microelectronics Packaging Technologies, 5 op
521089S: Printed Electronics, 5 op
521098S: Testing Techniques of Electronics and Printed Electronics, 5 op

Wireless communication engineering
521303A: Circuit Theory 2, 5 op
521384A: Basics in Radio Engineering, 5 op
521304A: Filters, 5 op
521395S: Wireless Communications I, 5 op
521340S: Communications Networks I, 5 op
521349S: Wireless Communications II, 5 op

Biomedical engineering (previous Medical and Wellness Technology)
555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440265: Complementary Module, Medical and Wellness Technology, 20 - 30 op

Electives
764327A: Virtual measurement environments, 5 op
521273S: Biosignal Processing I, 5 op
080929S: Health Technology and Multimodal Monitoring, 5 op
521097S: Wireless Measurements, 5 op
080916S: Biomechanics of Human Movement, 5 op
521093S: Biomedical Instrumentation, 5 op
080927S: Connected Health and mHealth, 5 op

Software Engineering
555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440266: Complementary Module, Software Engineering, 20 - 30 op

Common studies
811372A: Software Development, Maintenance and Operations, 5 op

Software Production
811373A: Professional Software Engineering Processes and Human Factors, 5 op
812331A: Interaction Design, 5 op
521041A: Applied Computing Project I, 8 op
811602S: Advanced Software Quality and Security, 5 op
811603S: Software Platforms and Ecosystems, 5 op
521156S: Towards Data Mining, 5 op
811604S: Software for Intelligent Systems and Artificial Intelligence (AI), 5 op

Information systems
813623S: Information Security Policy and Management in Organisations, 5 op
521453A: Operating Systems, 5 op
811312A: Data Structures and Algorithms, 5 op
Information Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440267: Complementary Module, Information Engineering, 20 - 30 op

Artificial Intelligence
521156S: Towards Data Mining, 5 op  
521289S: Machine Learning, 5 op  
521283S: Big Data Processing and Applications, 5 op  
811168P: Information Security, 5 op

Computer Science
521453A: Operating Systems, 5 op
031023P: Mathematical Structures for Computer Science, 5 op
521286A: Computer Systems, 8 op
521043S: Internet of Things, 5 op
521348S: Statistical Signal Processing 1, 5 op

Mining Technology and Mineral Processing

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440264: Complementary Module, Mining Technology and Mineral Processing, 20 - 30 op

Electives
493300A: Principles of mineral processing, 5 op
493302A: Chemical phenomena in mineral processes, 5 op
772335A: Introduction to ore mineralogy, 5 op
493605S: Ore beneficitation technologies, 5 op

Mechanical Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440255: Supplementary Module, Mechanical Engineering, 20 - 30 op

Common courses
462107A: Maintenance of machines, 5 op
462109S: Simulation and modelling of machines, 8 op
521043S: Internet of Things, 5 op

Machine Design
462103A: Introduction to Maintenance, 5 op
462101A: Information technology and machines, 5 op
462102A: Machine automation actuators, 5 op
464105S: Computer aided design, 5 op
462105A: Machine Sensor Technology, 5 op
462111S: Machine diagnostics, 10 op

Mechatronics
521077P: Introduction to Electronics, 5 op
521302A: Circuit Theory 1, 5 op
461106A: Dynamics, 5 op
462110S: Advanced course in mechatronics, 8 op
521160P: Introduction to Artificial Intelligence, 5 op

Production engineering
462104A: Machine automation, 5 op
463104A: Advanced manufacturing methods, 7 op
463109S: Computer aided manufacturing, 7 op

Process Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440249: Supplementary Module, Process Engineering, 20 - 30 op

Process engineering
477304A: Separation Processes, 5 op
477203A: Process Design, 5 op
477309S: Process and Environmental Catalysis, 5 op
477204S: Chemical Engineering Thermodynamics, 5 op

Process Engineering B
477123S: Chemical processing of biomasses, 5 op
477124S: Mechanical processing of biomasses, 5 op
477126S: Manufacturing of fibre products, 5 op
477128S: Circular Bioeconomy, 5 op

Automation engineering
477621A: Control System Analysis, 5 op
477622A: Control System Design, 5 op
477524S: Process Optimization, 5 op
477624S: Control System Methods, 5 op

Civil and Construction Engineering (previous Civil Engineering)

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440263: Complementary Module, Civil Engineering, 20 - 30 op

Structural Engineering
485109A: Numerical methods in structural engineering, 5 op
485106A: Design of concrete structures, 5 op
485108A: Design of Steel Structures and Steel Construction, 5 op
485107A: Timber construction and product technology, 5 op

Traffic and road construction engineering
485401A: Basics of Traffic Engineering, 5 op
485402S: Advanced Course in Traffic Engineering, 5 op
485403A: Basics of Road Engineering, 5 op
485404S: Road Design and Construction, 5 op

Environmental Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440256: Supplementary Module, Environmental Engineering, 20 - 30 op

Environmental Engineering A
488209S: Renewable Energy, 5 op
488501S: Smart Grid I: Integrating renewable energy sources, 5 op
488502S: Smart Grid II: Smart buildings/smart customers in the smart grid, 5 op
488503S: Smart Grid III: Smart energy networks, 5 op

Environmental engineering B
477309S: Process and Environmental Catalysis, 5 op
488203S: Industrial Ecology, 5 op
488214S: Air Pollution Control Engineering - Practical Solutions, 5 op
488215S: Industry and Environment, 5 op

Environmental engineering C
488110S: Water and Wastewater Treatment, 5 op
488134S: Hydrogeology and groundwater engineering, 5 op
488135S: Water distribution and sewage networks, 5 op
488206S: Sustainable Energy Project, 5 op

Other engineering module

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

ELECTIVE STUDIES, 0 - 10 ECTS cr (enintään 10 op)

If the minimum of the degree's courses of 90 ECTS cr is not completed, you can complete the degree with elective studies. The courses 555212P Orientation Course for New Students, 030008P Information Skills for Foreign Degree Students and 900017Y Survival Finnish Course are compulsory for new International Master's Program students. Also studies in language -, business or entrepreneurship are recommended. For IMP's students Finnish language studies are recommended. More information can be found in WebOodi's course catalogues (example Oulu Business School and Extension School) and in Peppi Study Guide/Minor subject.

555306M: Elective Studies in other Universities /Institutes, 0 - 30 op
A440269: Special Module, 0 - 10 op

International students should select 555212P, 030008P and 900017Y
555212P: Orientation Course for New Students, 1 op
030005P: Information Skills, 1 op
MASTER’S THESIS and related Studies, 30 ECTS cr (30 op)
555300S: Master’s Thesis, 30 op
555302S: Maturity Test / Master of Science in Industrial Engineering and Management, 0 op

Master of Science in Technology, Industrial Engineering and Management/ Production Management

Tutkintorakenteen tila: published
Lukuvuosi: 2020-21
Lukuvuoden alkamispäivämäärä: 01.08.2020

MAJOR STUDIES: 40 ECTS cr (40 op)
555307M: Common Studies of the Majors in other Universities /Institutes, 0 - 30 op
A440231: Major Studies, Production Management, 40 op
Compulsory
  555313S: Management, 5 op
  555314S: Management Information Systems, 5 op
  555301S: Research Seminar, 5 op
  555304S: Advanced Internship, 5 op
  555330S: Sourcing Management, 5 op
  555331S: Advanced Supply Chain Management, 5 op
  555332S: Operations and supply network analytics, 5 op
  555333S: Production Management, 5 op

SUPPLEMENTARY MODULE 1: Supplementary studies, 20 ECTS cr (vähintään 20 op)
The total extent of the major studies and the supplementary module 1 should be at least 60 ECTS cr.

1. Select one of the modules 11 - 13. The instruction language in the module 13 is Finnish. The courses in a module are compulsory.
2. Fill the selected module with other major's, other module's or elective advanced studies (the list is included in the modules) so that the total extend of the major studies is at least 60 ECTS cr.

Module 11: Organisation and knowledge management
555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op
A440259: Complementary Study Module of the Major/ Organization and Knowledge management, Advanced Module, 10 op
Obligatory studies of Organisation and knowledge management
  555370S: Strategic Management, 5 op
  555371S: Human Resource Management, 5 op
Elective advanced studies
  555377S: Risk Management, 5 op
  555378S: Seminar in industrial engineering and management, 5 op
  555379S: Research Project in Industrial Engineering and Management, 5 op
Project Management
  555391S: Advanced Course in Project Management, 5 op
555382S: Management of a project-based firm, 5 op

**Process and Quality Management**
- 555390S: Process Analytics, 5 op
- 555389S: Systematic Process Improvement, 10 op

**Product Management**
- 555350S: Research and Technology Management, 5 op
- 555351S: Advanced Course in Product Development, 5 op
- 555343S: Product Data and product life cycle management, 5 op
- 555346S: Product portfolio management, 5 op

**Production Management**
- 555330S: Sourcing Management, 5 op
- 555331S: Advanced Supply Chain Management, 5 op
- 555332S: Operations and supply network analytics, 5 op
- 555333S: Production Management, 5 op

**Module 12: Project Management**

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op
A440260: Complementary Study Module of the Major/ Project Management, Advanced Module, 10 op

**Obligatory studies of Project Management**
- 555391S: Advanced Course in Project Management, 5 op
- 555382S: Management of a project-based firm, 5 op
- 555392S: Change Project and Programme Management, 5 op

**Elective advanced studies**
- 555376S: Sustainable organisational development, 5 op
- 555377S: Risk Management, 5 op
- 555378S: Seminar in industrial engineering and management, 5 op
- 555379S: Research Project in Industrial Engineering and Management, 5 op

**Organisation and knowledge management**
- 555370S: Strategic Management, 5 op
- 555371S: Human Resource Management, 5 op

**Process and Quality Management**
- 555390S: Process Analytics, 5 op
- 555389S: Systematic Process Improvement, 10 op

**Product Management**
- 555350S: Research and Technology Management, 5 op
- 555351S: Advanced Course in Product Development, 5 op
- 555343S: Product Data and product life cycle management, 5 op
- 555346S: Product portfolio management, 5 op

**Operations and supply network management**
- 555330S: Sourcing Management, 5 op
- 555331S: Advanced Supply Chain Management, 5 op
- 555332S: Operations and supply network analytics, 5 op
- 555333S: Production Management, 5 op

**Module 13: Process and Quality Management**

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op
A440261: Complementary Study Module of the Major/ Process and Quality Management, Advanced Module, 15 op

**Obligatory studies of Process and Quality Management**
- 555390S: Process Analytics, 5 op
- 555389S: Systematic Process Improvement, 10 op

**Elective advanced studies**
- 555376S: Sustainable organisational development, 5 op
- 555377S: Risk Management, 5 op
- 555378S: Seminar in industrial engineering and management, 5 op
- 555379S: Research Project in Industrial Engineering and Management, 5 op

**Project Management**
- 555391S: Advanced Course in Project Management, 5 op
- 555382S: Management of a project-based firm, 5 op

**Organisation and knowledge management**
- 555370S: Strategic Management, 5 op
- 555371S: Human Resource Management, 5 op
Production Management
555330S: Sourcing Management, 5 op
555331S: Advanced Supply Chain Management, 5 op
555332S: Operations and supply network analytics, 5 op
555333S: Production Management, 5 op

Product Management
555350S: Research and Technology Management, 5 op
555351S: Advanced Course in Product Development, 5 op
555343S: Product Data and product life cycle management, 5 op
555346S: Product portfolio management, 5 op

SUPPLEMENTARY MODULE 2: Engineering and other IEM studies, 20 ECTS cr (vähintään 20 op)

Master's Programme student (2 year education) should select 'other IEM' studies.

Degree Programme student (5 year education) should select 'engineering' studies.

Other Industrial Engineering and Management Studies

A440270: Complementary Module, Other Industrial Engineering and Management Studies, 20 - 30 op

Elective studies (max 10 cr)
555226A: Operations and supply chain management, 5 op
555242A: Product development, 5 op
555285A: Project management, 5 op
555286A: Process and quality management, 5 op

Elective advanced studies
555377S: Risk Management, 5 op
555376S: Sustainable organisational development, 5 op
555378S: Seminar in industrial engineering and management, 5 op
555379S: Research Project in Industrial Engineering and Management, 5 op

Project Management
555391S: Advanced Course in Project Management, 5 op
555382S: Management of a project-based firm, 5 op

Organization and knowledge management
555370S: Strategic Management, 5 op
555371S: Human Resource Management, 5 op

Process and Quality Management
555390S: Process Analytics, 5 op
555389S: Systematic Process Improvement, 10 op

Product Management
555350S: Research and Technology Management, 5 op
555351S: Advanced Course in Product Development, 5 op
555343S: Product Data and product life cycle management, 5 op
555346S: Product portfolio management, 5 op

Production Management
555330S: Sourcing Management, 5 op
555331S: Advanced Supply Chain Management, 5 op
555332S: Operations and supply network analytics, 5 op
555333S: Production Management, 5 op
555309M: Supplementary Studies of the Majors in other Universities /Institutes, 0 - 60 op

Electronics and Communications Engineering (previous Electrical Engineering)
555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440253: Supplementary Module, Electrical Engineering, 20 - 30 op

Electronics
521432A: Electronics Design I, 5 op
521070A: Introduction to Microfabrication Techniques, 5 op
521404A: Digital Techniques 2, 5 op
521307A: Laboratory Exercises on Analogue Electronics, 5 op
521075S: Microelectronics Packaging Technologies, 5 op
Wireless communication engineering

521303A: Circuit Theory 2, 5 op
521384A: Basics in Radio Engineering, 5 op
521304A: Filters, 5 op
521395S: Wireless Communications I, 5 op
521340S: Communications Networks I, 5 op
521349S: Wireless Communications II, 5 op

Biomedical engineering (previous Medical and Wellness Technology)

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440265: Complementary Module, Medical and Wellness Technology, 20 - 30 op
Electives

764327A: Virtual measurement environments, 5 op
521273S: Biosignal Processing I, 5 op
080929S: Health Technology and Multimodal Monitoring, 5 op
521097S: Wireless Measurements, 5 op
080916S: Biomechanics of Human Movement, 5 op
521093S: Biomedical Instrumentation, 5 op
080927S: Connected Health and mHealth, 5 op

Software Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440266: Complementary Module, Software Engineering, 20 - 30 op
Common studies

811372A: Software Development, Maintenance and Operations, 5 op
Software Production

811373A: Professional Software Engineering Processes and Human Factors, 5 op
812331A: Interaction Design, 5 op
521041A: Applied Computing Project I, 8 op
811602S: Advanced Software Quality and Security, 5 op
811603S: Software Platforms and Ecosystems, 5 op
521156S: Towards Data Mining, 5 op
811604S: Software for Intelligent Systems and Artificial Intelligence (AI), 5 op
Information systems

813623S: Information Security Policy and Management in Organisations, 5 op
521453A: Operating Systems, 5 op
811312A: Data Structures and Algorithms, 5 op

Information Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440267: Complementary Module, Information Engineering, 20 - 30 op
Artificial Intelligence

521156S: Towards Data Mining, 5 op
521289S: Machine Learning, 5 op
521283S: Big Data Processing and Applications, 5 op
811168P: Information Security, 5 op
Computer Science

521453A: Operating Systems, 5 op
031023P: Mathematical Structures for Computer Science, 5 op
521286A: Computer Systems, 8 op
521043S: Internet of Things, 5 op
521348S: Statistical Signal Processing 1, 5 op

Mining Technology and Mineral Processing

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440264: Complementary Module, Mining Technology and Mineral Processing, 20 - 30 op
Electives
493300A: Principles of mineral processing, 5 op
493302A: Chemical phenomena in mineral processes, 5 op
772335A: Introduction to ore mineralogy, 5 op
493605S: Ore beneficitation technologies, 5 op

Mechanical Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440255: Supplementary Module, Mechanical Engineering, 20 - 30 op

Common courses
462107A: Maintenance of machines, 5 op
462109S: Simulation and modelling of machines, 8 op
521043S: Internet of Things, 5 op

Machine Design
462103A: Introduction to Maintenance, 5 op
462101A: Information technology and machines, 5 op
462102A: Machine automation actuators, 5 op
464105S: Computer aided design, 5 op
462105A: Machine Sensor Technology, 5 op
462111S: Machine diagnostics, 10 op

Mechatronics
521077P: Introduction to Electronics, 5 op
521302A: Circuit Theory 1, 5 op
461106A: Dynamics, 5 op
462110S: Advanced course in mechatronics, 8 op
521160P: Introduction to Artificial Intelligence, 5 op

Production engineering
462104A: Machine automation, 5 op
463104A: Advanced manufacturing methods, 7 op
463109S: Computer aided manufacturing, 7 op

Process Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440249: Supplementary Module, Process Engineering, 20 - 30 op

Process engineering
477304A: Separation Processes, 5 op
477203A: Process Design, 5 op
477309S: Process and Environmental Catalysis, 5 op
477204S: Chemical Engineering Thermodynamics, 5 op

Process Engineering B
477123S: Chemical processing of biomasses, 5 op
477124S: Mechanical processing of biomasses, 5 op
477126S: Manufacturing of fibre products, 5 op
477128S: Circular Bioeconomy, 5 op

Automation engineering
477621A: Control System Analysis, 5 op
477622A: Control System Design, 5 op
477524S: Process Optimization, 5 op
477624S: Control System Methods, 5 op

Civil and Construction Engineering (previous Civil Engineering)

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440263: Complementary Module, Civil Engineering, 20 - 30 op

Structural Engineering
485109A: Numerical methods in structural engineering, 5 op
485106A: Design of concrete structures, 5 op
485108A: Desing of Steel Structures and Steel Construction, 5 op
485107A: Timber construction and product technology, 5 op

Traffic and road construction engineering
485401A: Basics of Traffic Engineering, 5 op
485402S: Advanced Course in Traffic Engineering, 5 op
Environmental Engineering

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
A440256: Supplementary Module, Environmental Engineering, 20 - 30 op
  Environmental Engineering A
    488209S: Renewable Energy, 5 op
    488501S: Smart Grid I: Integrating renewable energy sources, 5 op
    488502S: Smart Grid II: Smart buildings/smart customers in the smart grid, 5 op
    488503S: Smart Grid III: Smart energy networks, 5 op
  Environmental engineering B
    477309S: Process and Environmental Catalysis, 5 op
    488203S: Industrial Ecology, 5 op
    488214S: Air Pollution Control Engineering - Practical Solutions, 5 op
    488215S: Industry and Environment, 5 op
  Environmental engineering C
    488110S: Water and Wastewater Treatment, 5 op
    488134S: Hydrogeology and groundwater engineering, 5 op
    488135S: Water distribution and sewage networks, 5 op
    488206S: Sustainable Energy Project, 5 op

Other engineering module

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

ELECTIVE STUDIES, 0 - 10 ECTS cr (enintään 10 op)

If the minimum of the degree’s courses of 90 ECTS cr is not completed, you can complete the degree with elective studies. The courses 555212P Orientation Course for New Students, 030008P Information Skills for Foreign Degree Students and 900017Y Survival Finnish Course are compulsory for new International Master's Program students. Also studies in language, business or entrepreneurship are recommended. For IMP's students Finnish language studies are recommended. More information can be found in WebOodi's course catalogues (example Oulu Business School and Extension School).

555306M: Elective Studies in other Universities /Institutes, 0 - 30 op
A440269: Special Module, 0 - 10 op
  International students should select 555212P, 030008P and 900017Y
    555212P: Orientation Course for New Students, 1 op
    030005P: Information Skills, 1 op
    030008P: Information Skills for foreign degree students, 1 op
    900017Y: Survival Finnish, 2 op
  Recommended studies
    555214A: Working in the university community, 5 op
    555215A: Working life project, 5 op

MASTER'S THESIS and related Studies, 30 ECTS cr (30 op)

555300S: Master’s Thesis, 30 op
555302S: Maturity Test / Master of Science in Industrial Engineering and Management, 0 op

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

902142Y: Business Correspondence, 2 op
Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohtteiden kuvaukset

555207M: Basic Studies in other Universities/ Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

A440120: Basic and Intermediate Studies, Industrial Engineering and Management, 119,5 - 120 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Basic and Intermediate Studies
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

STUDY AND COMMUNICATION SKILLS

555203P: Study Skills, 2 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555212P Orientation Course for New Students 1.0 op

Person responsible:
University lecturer Osmo Kauppila
Other information:
Course tuition language is Finnish. Check the course description in Finnish.

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Faculty of Technology
Arvostelu: 1 - 5, pass, fail
Opettajat: Ursula Heinikoski
Opintokohteen kielet: Finnish
Leikkaavuudet:

030004P Introduction to Information Retrieval 0.0 op

ECTS Credits:
1 ECTS credit / 27 hours of work

Language of instruction:
Finnish

Timing:
Architecture 3. spring semester, period III;
biochemistry 3. autumn semester;
biochemistry 3. autumn semester, period I;
chemistry 3. autumn semester, period I;
civil engineering 2. spring semester, period IV;
computer science and engineering 2. spring semester, period IV;
electronics and communications engineering 3. spring semester;
geosciences 2. spring semester, period IV;
geography 3. semester, periods I and III;
industrial engineering and management 3. year;
information processing sciences 1. or 3. year;
mechanical engineering 3. year;
mining engineering and mineral processing 3. year;
process and environmental engineering 2. year, period II;
Master's degree students in industrial engineering and management 1st year.

Learning outcomes:
Upon completion of the course, the students:
- can search scientific information,
- can use the most important databases of their discipline,
- know how to evaluate search results and information sources,
- can use the reference management tool.

Contents:
Scientific information retrieval process, the most important databases and publication channels of the discipline, evaluation of the reliability of information sources and reference management tool.

Mode of delivery:
Blended teaching: classroom training, web-based learning material and exercises, a group assignment.

Learning activities and teaching methods:
Training sessions 8 h, group working 7 h, self-study 12 h

Target group:
Compulsory for all bachelor degree students of Faculty of information technology and electrical engineering, Faculty of Technology and Faculty of science. Compulsory also for those Master's degree students in Industrial Engineering and Management who have no earlier studies in the information skills. Optional for the students of biochemistry.

Recommended optional programme components:
In biochemistry the course is completed as a part of 740376A Bachelor’s Thesis.

**Recommended or required reading:**
Web learning material [Tieteellisen tiedonhankinnan opas](#)

**Assessment methods and criteria:**
Passing the course requires participation in the training sessions and successful completion of the course assignments.

**Grading:**
pass/fail

**Person responsible:**
Ursula Heinikoski

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**900061A: Scientific Communication for Production Engineering and Management, 2 op**

**Voimassaolo:** 01.08.2008 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuyksikkö:** Languages and Communication
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

**Proficiency level:**
This course is not offered in English. It is only Finnish-speaking students.

**Status:**
Compulsory for the students undertaking the bachelor's degree in the Industrial Engineering and Management.

**Required proficiency level:**
-

**ECTS Credits:**
2 credits

**Language of instruction:**
Finnish

**Timing:**
Periods 1-2 and 4.
The course begins in the first year of studies by introductory lessons and continues during the second or the third year of studies.

**Learning outcomes:**
The student should have mastered the basics of scientific communication. He/she should be able to view scientific writing as a process and prepare a scientific research report (among other scientific texts).

**Contents:**
Practises and distinctive features of scientific communication, writing as a process, critical and analytical reading strategies, style and language of science, essential questions of language planning.

**Mode of delivery:**
Multimodal teaching

**Learning activities and teaching methods:**
Introductory lessons 2 hrs, guiding in small gorups 3 hrs, distance teaching and independent study 49 hrs.

**Target group:**
Students undertaking the bachelor's degree in the Industrial Engineering and Management.

**Prerequisites and co-requisites:**
-

**Recommended optional programme components:**
The course is to be taken concurrently with the course 555204A Harjoittelu offered by the degree programme of Industrial Engineering and Management.

**Recommended or required reading:**
Material in Moodle

**Assessment methods and criteria:**
Active participation in contact and distance teaching, independent study and completion of given assignments.
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
Pass / fail

**Person responsible:**
Outi Mikkola

**Working life cooperation:**
Along with the course 555204A that includes practical training.

**Other information:**

900062P: Communicative Oral Skills for Production Engineering and Management, 2 op

**Voimassaolo:** 01.08.2008 -
**Opiskelumuoto:** Basic Studies
**Laji:** Course
**Vastuuysikkö:** Languages and Communication
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Niina Sarajärvi
**Opintokohteen kielet:** Finnish

**Proficiency level:**
This course is not offered in English. It is only Finnish-speaking students.

**Status:**
This course is obligatory for the Students of Industrial Engineering and Management and it is integrated to the Case course 555284A.

**Required proficiency level:**

**ECTS Credits:**
2 ECTS

**Language of instruction:**
Finnish

**Timing:**
the Autumn term of the 3rd year of studies

**Learning outcomes:**
Upon completion of the course the student should be familiar with the central principles of work and study-related communication, both oral and written, and be able to apply this knowledge in his/her own communication. The student should be able to analyse and assess his/her own writing and the writing of his/her peers. He/she should be able to act in group communication situations in a target-oriented manner. The student should also be able to give and receive constructive criticism. The student knows how to act efficiently in situations of group communication.

**Contents:**
Presentations, preparing a presentation, presenting techniques, argumentation, non-verbal communication, negotiating skills and conventions, observation and analysis of speech communication situations.

**Mode of delivery:**
multi-modal teaching

Learning activities and teaching methods:
Contact teaching and independent work

Target group:
Students of Industrial Engineering and Management

Prerequisites and co-requisites:

Recommended optional programme components:
This course is integrated to the Case course 555284A.

Recommended or required reading:
the material in the Optima learning environment

Assessment methods and criteria:
Active participation in contact teaching, independent study and completion of given assignments. Read more about assessment criteria at the University of Oulu webpage.

Grading:
1 - 5

Person responsible:
Sarajärvi, Niina

Working life cooperation:

Other information:
All the 2. practises are organized at TUTA-Studiem.

CHOOSE ONE

901044Y: Second Official Language (Swedish), Written Skills, 1 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuysikkö: Languages and Communication
Opintokohteen kielet: Swedish
Leikkaavuudet:

901060Y  Second Official Language (Swedish), Written Skills  1.0 op

Proficiency level:
This course is only for Finnish speaking students with CEFR-level A2 in Swedish language. University of Oulu, Languages and Communication unit don’t offer Beginners courses in Swedish.

Recommended optional programme components:

901045Y: Second Official Language (Swedish), Oral Skills, 1 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuysikkö: Languages and Communication
Opintokohteen kielet: Swedish
MATHEMATICS

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Pauliina Uusitalo
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay031010P Calculus I (OPEN UNI) 5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish. The course will be lectured also in English.

Timing:
Fall, period 1

Learning outcomes:
Upon completion of the course, the student
- knows how to solve inequalities and equations with absolute value
- identifies the concepts of vector algebra
- can use vector algebra for solving the problems of analytic geometry
- can explain basic characteristics of elementary functions
- is able to analyse the limit and the continuity of the real valued functions of one variable
- can analyse the local minima and maxima of a function
- knows how to find the derivative for a function given with parametric representation
- is able to evaluate the basic calculation of the complex numbers and can rewrite a complex number in its exponential form
- knows the connection between the integral and area
- knows integral techniques such as integration by parts, a substitution method and a partial fraction composition
- can solve problems associated with the differential and integral calculus of the real valued functions of one variable.

Contents:
- Inequalities and absolute value
- Vector algebra and analytic geometry
- Concept of the function and elementary functions
- Monotonicity of the function, the inverse function
- Limit values
- Derivative as limit value of the difference quotient. Derivatives of elementary functions
- The extreme values of a function
- Parameter presentation of the curve, polar coordinates, complex numbers
- Integral function and definite integral, applications
- Integration by parts, substitution method and integration of rational functions

Mode of delivery:
Blended learning, course material is in Moodle learning environment

Learning activities and teaching methods:
Lectures 28 h / Group work 22 h / Self-study 85 h

Target group:
1. year students of technical sciences, mathematics and physics

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The course is completed with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous assessment. The assessment of the course is based on the learning outcomes of the course. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:
Pauliina Uusitalo

Working life cooperation:
The course does not contain working live cooperation.

Other information:
-

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Matti Peltola
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay031078P  Matrix Algebra (OPEN UNI)  5.0 op
  031019P  Matrix Algebra  3.5 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn, during period 2. It is recommended to complete the course at the 1th autumn semester.

Learning outcomes:
The student is able to apply arithmetic operations of matrices and can solve system of linear equations by matrix methods and can apply matrix factorizations to find the solution of the system of linear equations. The student is able to recognize the vector space and understands the concepts of basis and dimension of a vector space and can analyse matrices by the parameters, vectors and vector spaces of matrices. He/She knows how to calculate determinant, eigenvalues and eigenvectors of a square matrix, and is able to diagonalize matrices and apply diagonalization to the simple problems.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:
1. year students of technical sciences, mathematics and physics.

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The course can be completed by intermediate exams (2 exams) or by a final exam. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail

Person responsible:
Matti Peltola

Working life cooperation:
-

Other information:
-

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Pauliina Uusitalo
Opintokohteen kielet: Finnish
Leikkaavuudet:
    ay031075P Calculus II (OPEN UNI) 5.0 op
    031011P Calculus II 6.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish. The course can be completed in English by intermediate exams or by a final exam.

Timing:
Spring semester, period 3

Learning outcomes:
Upon completion of the course, the student is able to examine the convergence of series and power series of real terms, can explain the use of power series e.g. in calculating limits, is able to solve problems related to differential and integral calculus of real and vector valued functions of several variables.
Contents:
Sequences, series, power series and Fourier series of real terms. Differential and integral calculus of real and vector valued functions of several variables.

Mode of delivery:
Online teaching

Learning activities and teaching methods:
Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:
-

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the course 031010P Calculus I.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
Intermediate exams or a final exam. The exams are remote exams. It is possibility to take exams also at the university.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:
Pauliina Uusitalo

Working life cooperation:
-

Other information:
-

031076P: Differential Equations, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettaja: Ruotsalainen Keijo
Opintokohteen kielet: Finnish
Leikkaavuudet:
    ay031076P    Differential Equations (OPEN UNI)    5.0 op
    800320A    Differential equations    5.0 op
    031017P    Differential Equations    4.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring, during period 4. It is recommended to complete the course at the 1th spring semester.
Learning outcomes:
The students can apply differential equations as a mathematical model. They can identify and solve various
differential equations and they have knowledge on basic solvability of differential equations. The student
can use the Laplace transform as a solution method.

Contents:
Ordinary differential equations of first and higher order.
Laplace transform with applications to differential equations.

Mode of delivery:
Online teaching, Stack/Moodle digital learning environment

Learning activities and teaching methods:
Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:
1. year students of engineering, mathematics and physics.

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the course Calculus I.

Recommended optional programme components:

Recommended or required reading:
Recommended literature: Kreyszig, E: Advanced Engineering Mathematics;

Assessment methods and criteria:
The course can be completed by intermediate exams (2 exams) or by a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:
Keijo Ruotsalainen

Working life cooperation:
No

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Kemppainen
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay031021P Probability and Mathematical Statistics (OPEN UNI) 5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
Spring semester, period 3

Learning outcomes:
After completing the course the student
1. knows the key concepts of probability and the most important random variables,
2. will be able to use them in calculating probabilities and parameters of probability distributions,
3. is capable of analyzing statistical data by calculating interval and point estimates for the parameters,
4. will be able to formulate statistical hypotheses and test them,
5. knows the basics of linear regression.

Contents:
The key concepts of probability, random variable, parameters of probability distributions, estimation of parameters, hypothesis testing, regression analysis.

Mode of delivery:
Online teaching

Learning activities and teaching methods:
Lectures 28 h/Exercises 20 h/Self study 87 h.

Target group:
The students in the engineering sciences. Other students are welcome, too.

Prerequisites and co-requisites:
The recommended prerequisites are the course 031010P Calculus I and some parts of the course 031075P Calculus II.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
Intermediate exams or a final exam. The exams are remote exams. It is possibility to take exams also at the university.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:
Jukka Kemppainen

Working life cooperation:

PHYSICS

761118P: Mechanics 1, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Physics
Arvostelu: 1 - 5, pass, fail
Opettajat: Aku Venhola
Opintokohteen kielet: Finnish
Leikkaavuudet:

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ECTS Credits:
5 ECTS credits / 133 hours of work
Language of instruction:
The lectures will be in Finnish. The textbook is in English and exercises are selected from the textbook. For further information, contact the responsible person of the course.

Timing:
Autumn

Learning outcomes:
The student is able to describe the basic concepts of mechanics and to apply those when solving the problems related to mechanics.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 30 h, 7 exercises (14 h), 2 laboratory exercises (3 hours/exercise), self-study 83 h

Target group:
For the students of the University of Oulu.

Prerequisites and co-requisites:
Knowledge of vector calculus and basics of differential and integral calculus.

Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously.

Recommended or required reading:

Assessment methods and criteria:
Both parts (761118P-01 and 761118P-02) will be graded separately. The final grade of the course is the weighted average of the grades of part 1 (4 cr) and part 2 (1 cr).
761118P-01: Two midterm exams or final examination
761118P-02: Two laboratory exercises.

Grading:
Numerical grading scale 0 – 5, where 0 = fail

Person responsible:
Aku Venhola

Working life cooperation:
No work placement period
Learning outcomes:
The student will be able to understand the basic concepts of electromagnetism and can apply this understanding to solve problems related to electromagnetism.

Contents:
Basic principles of electromagnetic phenomena and their physical and geometric interpretation. More detailed contents will be presented later.

Mode of delivery:
face-to-face teaching

Learning activities and teaching methods:
Lectures 32 h, 7 exercises (14 h), 2 laboratory exercises (3 hours/exercise), self-study 83 h

Target group:
For the students of the University of Oulu.

Prerequisites and co-requisites:
Knowledge of vector calculus and basics of differential and integral calculus.

Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously.

Recommended or required reading:

Assessment methods and criteria:
Both parts (761119P-01 and 761119P-02) will be graded separately. The final grade of the course is the weighted average of the grades of part 1 (4 cr) and part 2 (1 cr).
- 761119P-01: Three small midterm exams or final examination
- 761119P-02: Two laboratory exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 0 – 5, where 0 = fail

Person responsible:
Timo Asikainen

761310A: Wave motion and optics, 5 op
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Leikkaavuudet:

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ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish. The course material and exercises are available in English.

Timing:
First spring

Learning outcomes:
The student is able to treat different types of waves by methods of general theory of wave motion. The student is also able to solve problems related to basic optics and apply her/his knowledge to teaching and research in physics.

Contents:
General principles of wave motion, sound, electromagnetic waves, propagation of light, image formation in mirrors and lenses, optical instruments, interference, Fraunhofer diffraction, diffraction grating.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h, exercises 14 h, 2 laboratory exercises (3 hours/exercise), self-study 90 h

Target group:
No specific target group

Prerequisites and co-requisites:
Basic skills in mathematics.

Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Assessment methods and criteria:
Two written intermediate examinations or one final examination

Grading:
Numerical grading scale 0 – 5, where 0 is fail

Person responsible:
Seppo Alanko

Working life cooperation:
No work placement period

Other information:
Includes parts:
761310A-01 Wave motion and optics, lectures and exam
761310A-02 Wave motion and optics, lab. exercises
521141P: Elementary Programming, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Mika Oja
Opintokohteen kielet: Finnish
Leikkaavuudet:
   ay521141P  Elementary Programming (OPEN UNI)  5.0 op
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS Cr
Language of instruction:
Lectures and learning material are in Finnish. The course is not available English.

Timing:
Fall, periods 1-2.

Learning outcomes:
1. Is capable of solving problems in the computer's terms
2. Understands the basic concepts of programming
3. Knows the basics of the Python programming language
4. Is able to implement programs independently
5. Is able to use the internet to find information about programming

Contents:
Problem solving with programming, basic concepts of programming, writing Python code.

Mode of delivery:
Web-based teaching + face-to-face teaching

Learning activities and teaching methods:
30h of exercise groups, 105h self-studying in the web.

Target group:
1st year students of computer science and engineering, electrical engineering, medical and wellness technology and industrial and engineering management, 2nd year students of physics, and other students of the University of Oulu

Prerequisites and co-requisites:
None.

Recommended optional programme components:
The course provides a basis for subsequent programming courses.

Recommended or required reading:
Web material in an online learning environment. Address will be announced at the beginning of the course.

Assessment methods and criteria:
The course is completed by passing all learning assignments, programming exercises and a final exercise project. Read more about assessment criteria at the University of Oulu webpage
Read more about assessment criteria at the University of Oulu webpage.

Grading:
pass/fail.

**Person responsible:**
Mika Oja

**Working life cooperation:**
-

**Other information:**
The course learning platform is Lovelace (lovelace.oulu.fi)

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**811104P: Programming 1, 5 op**

- **Voimassaolo:** 01.08.2019 -
- **Opiskelumuoto:** Basic Studies
- **Laji:** Course
- **Vastuuysikkö:** Information Processing Science DP
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Lappalainen, Jouni Esko Antero
- **Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- ay811104P Programming 1 (OPEN UNI) 5.0 op
- 811122P Introduction to Programming 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester of the Bachelor's studies.

**Learning outcomes:**
After completion of this course, the student will be able to:
* create simple working programs
* identify and use the basic control structures of a program.
* identify the concepts of modularity, table, storage of information.
* apply the concepts of modular structure, tables and information storage techniques into a program.
* find and fix errors in the program.
* solve a computational problem by using abstraction and stepwise refinement
* explain the concept of recursion.
* operate with binary and hexadecimal number systems, as well as knows the presentation of numbers on a computer.
* document the program.

**Contents:**

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Theory studies at lectures and/or online (in Finnish) 40h, programming exercises in a computer lab and/or an online learning environment 24h, self-study 70h

**Target group:**
BSc students

**Recommended or required reading:**
Deitel, Deitel: C HOW TO PROGRAM; Pearson Education Inc. 2007, or a newer edition. Lecture slides.
Assessment methods and criteria:
1. Final exam and exercise points and programming assignment. OR 2. Mid-term exams (2) and exercise points and home programming assignment.

Grading:
Numerical scale 1-5 or fail

Person responsible:
Jouni Lappalainen

ECONOMICS

724110P: Introductory Economics, 5 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Marko Korhonen
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay724110P Introductory Economics (OPEN UNI) 5.0 op
721211P Principles of Economics 10.0 op
721210P Economics for Business 5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 credits

Language of instruction:
Finnish

Timing:
Period 1 (1st year)

Learning outcomes:
After completing the course students (i) understand the basic concepts of economics and the rudiments of economic theory, (ii) can explain the determination of resource allocation and prices in a market economy, (iii) know how the aggregate economy operates in the short and long run, and (iv) how economic policy affects the economy.

Contents:
The course introduces students to the tools and ideas economics uses to describe and explain economic phenomena. The topics include:
- basic ideas and principles of economics
- opportunity cost and comparative advantage
- market equilibrium: demand and supply
- how well does market economy work?
- firms and competition in market economy
- aggregate economic activity and its measurement
- business cycles
- economic growth

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
36 lectures including possible problem sets. Students are expected to do the problem sets on their own and familiarize themselves with the required and recommended materials (93 h). Mid-term exams or Final Exam

**Target group:**
Major students in economics and business administration

**Prerequisites and co-requisites:**
-

**Recommended optional programme components:**
This course is part of “Introduction to business studies” -module

**Recommended or required reading:**
Material posted at the webpage. Textbook:

**Assessment methods and criteria:**
Mid-term exams or Final exam

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Marko Korhonen

**Working life cooperation:**
Students learn relevant and useful facts about the operation of the markets, and the aggregate economy to an extent that they can reasonably utilize those facts and knowledge in the decision making of the business they are working at.

**Other information:**
The number of students is limited.

724105P: Management Accounting, 5 op

**Voimassaolo:** 01.08.2014 -
**Opiskelumuoto:** Basic Studies
**Laji:** Course
**Vastuuysikkö:** Oulu Business School
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Marjo Väisänen
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- ay724105P Management Accounting (OPEN UNI) 5.0 op
- 721172P Management Accounting 5.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**
5 credits

**Language of instruction:**
English (course is lectured separately in Finnish and in English).

**Timing:**
Period 1 (2nd year)

**Learning outcomes:**
After passing the course, the student knows the basic cost concepts and the elements of cost accounting systems. Students are also able to apply the basic cost information in the company’s decision making and explain which costs should be included in these calculations under different circumstances.

**Contents:**
Theoretical framework for understanding cost accounting, cost concepts, cost recording, different product costing methods, cost-volume-profit analysis, using cost accounting information in decision making.

**Mode of delivery:**
Face-to-face teaching.

**Learning activities and teaching methods:**
20 h lectures, 14 h exercises and independent reading of study materials and doing assignments (99 hours).

**Target group:**
Major students in economics and business administration

**Prerequisites and co-requisites:**

**Recommended optional programme components:**
This course is part of "Business Processes" -module

**Recommended or required reading:**
Supplementary material: Järvenpää, M. - Länsiluoto, A - Partanen, V. – Pellinen, J.: Talousohjaus ja kustannuslaskenta, WSOYpro, chapters 1-8

**Assessment methods and criteria:**
Lectures and literature examination.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Marjo Väisänen

**Working life cooperation:**
Understanding of management accounting systems is typically an important part of work for graduates in economics and business administration and an essential part of occupations like management accountant or controller.

**Other information:**
The number of students is limited.

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**555213A: Sales and marketing, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Jukka Majava
**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish. English material is also used.

**Timing:**
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand and apply basic terminology of sales and marketing and the fundamentals of customer oriented approach
- recognise sales and marketing process phases, plan product and service offerings for a particular customer segment, and create sales and marketing plan
- explain the following concepts: sales pipeline, segmentation, marketing mix, value proposition and branding
- listen and develop a customer’s need, and present and defend one’s own value proposition

Contents:
Customer’s buying behavior, planning product and service offerings, communicating value, basics of sales and marketing, customer oriented approach, sales and marketing processes and plans, sales pipeline, segmentation, value proposition, marketing mix and branding.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures and exercises 18 h / group work 79 h / self-study 37 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management, 724105P Management accounting or similar knowledge.

Recommended optional programme components:
-

Recommended or required reading:
Parviainen, P. (2013) Myyntipsykologia: Näin meille myydään. Docendo Oy. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilises continuous assessment. During the course, there are individual assignments and a sales simulation exercise (50 % of the grade) and a group work (50 % of the grade).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The students will do a group work in cooperation with case companies.

Other information:

IEM STUDIES

555225P: Basics of industrial engineering and management, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Basic Studies
**Course**

**Field of Industrial Engineering and Management**

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Elina Jääskä

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

- ay555225P Basics of industrial engineering and management (OPEN UNI) 5.0 op
- 555221P Introduction to Production 2.0 op
- 555220P Basic Course in Industrial Engineering and Management 3.0 op

**ECTS Credits:**

5 ECTS credits.

**Language of instruction:**

Finnish. English material is also used.

**Timing:**

Period 1.

**Learning outcomes:**

Upon completion of the course, the student will be able to:

- describe what industrial engineering and management (or operations management) means
- explain the core concepts of business operations and utilise these concepts in describing and analysing operations of an organisation
- explain in general terms the factors that affect economic performance of organisations
- utilise the terminology used in industrial engineering and management (operations management), describe the financial processes of companies and based on this describe the use of cost accounting in organisational decision-making
- calculate unit costs in various simplified settings, calculate various alternatives, as well as perform planning and goal oriented calculations based on given data, and draw conclusions based on the calculation results

**Contents:**

Operations and productivity, operations strategy, forecasting, accounting and cost accounting, investments and financial planning, sustainability, capacity management, location decisions, layout strategies, human resources management, supply chain management, subcontracting, inventory management, production planning, MRP & ERP, production scheduling, Just-in-Time & Lean operations, maintenance.

**Mode of delivery:**

Web-based teaching 20 hours / practices 14 hours / Independent studying 100 hours.

**Learning activities and teaching methods:**

Web-based lectures 20 h / exercises 14 h / self-study 100 h.

**Target group:**

Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

**Prerequisites and co-requisites:**

No prerequisites exist.

**Recommended optional programme components:**

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

**Recommended or required reading:**


**Assessment methods and criteria:**
This course utilises continuous assessment. During the course, there are seven mandatory weekly assignments.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
MSc (Tech.) Elina Jääskä

**Working life cooperation:**
-

**Other information:**
Substitutes courses 555220P Basic Course in Industrial Engineering and Management 3 ECTS cr and 555221P Introduction to Production 2 ECTS cr.

555285A: Project management, 5 op

**Voimassaolo:** 01.01.2014 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 555288A Project Management 5.0 op
- ay555285A Project management (OPEN UNI) 5.0 op
- 555282A Project Management 4.0 op
- 555280P Basic Course of Project Management 2.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish. Check the course in English 555288A Project Management.

**Timing:**
Period 2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- describe and explain the essential concepts and methods related to project management
- apply project management methods to create a schedule for a project and calculate critical path
- understand essential concepts related to project cost management and able to apply earned value method and three point estimate to manage project costs
- recognises the essential tasks of project risk management

**Contents:**
Defining project management, project goals and objectives, project phases and project life-cycle management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management, project stakeholder management, project communications management, the role of project manager, new modes of project delivery

**Mode of delivery:**
The tuition will be implemented as web-based teaching.

**Learning activities and teaching methods:**
Web-based lectures 16h, self-study 118h
Target group:
Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
No prerequisites exist.

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:
Lecture material, exercise book, Artto, Martinsuo & Kujala 2006. Projektiliiketoiminta. WSOY

Assessment methods and criteria:
Weekly assignments and final online exam

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
Videos from the industry’s projects

Other information:
Substitutes courses 555280P Basic Course of Project Management + 555282A Project Management.

555265P: Occupational Safety and Health Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Henri Jounila
Opintokohteen kielet: Finnish
Leikkaavuudet:
555263A Technology, Society and Work 2.0 op
555260P Basic Course in Occupational Safety and Wellbeing at Work 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used.

Timing:
Periods 3-4.

Learning outcomes:
Upon completion of the course, the student will be able to:
• explain the basic terms of occupational safety and health
• assess the importance of occupational safety, health and well-being at work
• assess the significance of occupational safety in the improving of productivity and quality
• apply different safety analysis
• explain core issues of occupational safety and health management

Contents:
Occupational safety and health, safety management, safety culture, laws and standards, hazards and risks, occupational diseases and work accidents, safety analysis, occupational safety at shared industrial work sites, occupational safety card, HSEQ-assessment procedure, other current issues.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures and assignments 26 h / group work 40 h / tasks and self-study 68 h.

Target group:
Industrial Engineering and Management, Mechanical Engineering, Process Engineering and Environmental Engineering students.

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:
Mertanen V. 2015. Työturvallisuuden perusteet. Helsinki: Työterveyslaitos. Lecture materials. Other materials will be defined during the course.

Assessment methods and criteria:
Group work 0-5, the assessment of the tasks will be informed at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
MSc Henri Jounila

Working life cooperation:
-

Other information:
Substitutes courses 555260P Basic Course in Occupational Safety and Wellbeing at Work + 555263A Technology, Society and Work.

555226A: Operations and supply chain management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Farzad Pargar
Opintokohteen kielet: English
Leikkaavuudet:
   555222A Demonstration in Industrial Engineering and Management  2.0 op
   555223A Introduction to Production Control 3.0 op

ECTS Credits:
5 ECTS credits

Language of instruction:
Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- describe different production types
- apply different forecasting methods, plan needed production capacity, and apply location and transportation decisions related methods
- master common inventory management methods and aggregated and short-term scheduling
- create a sales and operations plan for a company

Contents:
Production types, forecasting methods, capacity planning and queuing models, location and transportation decisions, inventory management systems, aggregate scheduling, MRP & ERP, short-term scheduling, linear programming.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures 16 hours / independent studying 64 hours.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management or similar knowledge.

Recommended optional programme components:
Industrial Engineering and Management students will complete 902143Y Company presentations course simultaneously.

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. During the course, there are mandatory weekly assignments. At least half of the assignments must be passed. 40% of the grade is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Post-doctoral researcher Farzad Pargar.

Working life cooperation:
The group work will be done for a real company by using public information sources.

Other information:
Substitutes course 555222A Demonstration in Industrial Engineering and Management 2 ECTS cr and 555223A Introduction to Production Control 3 ECTS cr.
Previous course name was ‘Operations and Production’.

555264P: Managing well-being and quality of working life, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Reiman

Opintokohteen kielet: Finnish

Leikkaavuudet:
- ay555264P Managing well-being and quality of working life (OPEN UNI) 5.0 op
- 555261A Basic Course in Occupational Psychology 3.0 op
- 555262A Usability and Safety in Product Development 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used.

Timing:
Periods 3-4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- set targets and choose appropriate methods of developing well-being at work both at personal and organizational levels
- develop well-being at work in the contexts of labor legislation, good practices, productivity, occupational safety expertise, management and human resources
- know the key sources of information, typical goal-setting and management practices and the methods for assessing the performance at individual and organizational levels
- assess the economic impacts of well-being at work, especially in cases of work ability, occupational health, job satisfaction, occupational safety, productivity and the overall quality of working life
- know essential national and international regulation and strategic goal setting practices, good practices of the case companies, current trends, and methods in research.

Contents:
The course gives the student a vision of building sustainable, productive and satisfactory career. The contents cover the whole area of basic quality issues of working life analysing them in the following framework "Well-being at work means safe, healthy, and productive work in a well-led organisation by competent workers and work communities who see their job as meaningful and rewarding, and see work as a factor that supports their life management”.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures 10 h / self-study 70 h / group work & exercises 42 h.

Target group:
Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
No prerequisites exist.

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial Engineering and Management that also includes 555225P Basics of industrial engineering and management, 555285P Project Management, 555242A Product development, and 555286A Process and quality management.

Recommended or required reading:
Applicable parts of Arnold, J. et al. (2010), Work Psychology; Understanding Human Behaviour in the Workplace. 5th Edition. Financial Times/Prentice Hall and Aura, O. & Ahonen, G. Strate-gisen hyvinvoinnin johtaminen, Alma Talent. Other literature will be informed during the course.

Assessment methods and criteria:
This course utilises continuous assessment including exercises during the lectures (weight 20 %), group work (weight 40 %) and examination (weight 40 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Dr. Arto Reiman

Working life cooperation:
-

Other information:
Substitutes courses 555261A Basic Course in Occupational Psychology + 555262A Usability and Safety in Product Development.

555286A: Process and quality management, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay555286A Process and quality management (OPEN UNI)  5.0 op
  555281A Basic Course of Quality Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
  • explain the role of process and quality management in a business organisation
  • develop business processes based on the principles of quality management and appropriate tool

Contents:
Foundations of total quality management, planning of quality, performance measurement, process management, people management in relation to quality management, implantation of total quality management.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
20 h lectures, 114 h independent study

Target group:
Industrial Engineering and Management students and other students studying Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
-

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, and 555264P Managing well-being and quality of working life.
**Recommended or required reading:**

**Assessment methods and criteria:**
To pass the course, the student must pass the weekly course exercises (50% of the course grade) and an exam (50%).

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University lecturer Osmo Kauppila.

**Working life cooperation:**
No.

**Other information:**
Substitutes course 555281A Basic Course of Quality Management.

### 555242A: Product development, 5 op

**Voimassaolo:** 01.01.2014 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Haapasalo, Harri Jouni Olavi
**Opintokohteen kielet:** English

**Leikkaavuudet:**
- ay555242A  Product development (OPEN UNI)  5.0 op
- 555240A  Basic Course in Product Development  3.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Periods 1-2.

**Learning outcomes:**
This course introduces product development and innovations management in a company environment. The course provides fundamental understanding over tools and frameworks that can be used for analysing and managing products, innovations, and technology development. The aim is to create a connection between product development and other company functions. Upon completion of the course, the student will be able to
- explain the role of product development as a company function
- understand the difference between innovation activities and systematic product development, and knows the difference between different phases of product development process and its activities
- transform customer needs into requirements for product development process and finally into product features
- define the meaning of other company functions to product development activities

**Contents:**
Meaning of products for the operations of an industrial enterprise, product development paradigm and defining relevant concepts, realising product development methodologically (U&E model, Cooper’s stage-gate model, QFD), managing innovations, and product development success factors.

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching.
Learning activities and teaching methods:
Lectures 20 h / exercises 6 h / group work and self-study 108 h.

Target group:
Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555226A Operations and supply chain management (Operations and production)

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo.

Working life cooperation:
No.

Other information:
Substitutes course 555240A Basic Course in Product Development.

555287A: Problem Solving in Business Cases, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Pentti Annunen
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used.

Timing:
Periods 1-2.

Learning outcomes:
Upon completion the student can systematically analyse the challenges related to a company’s business as a part of a group, apply problem solving tools and processes to develop and present alternative solutions to business challenges related to strategy or operations. The student is able to analyse and develop the functioning of a group. The student is able to evaluate and improve his/her presentation skills.
Contents:
Problem solving tools and processes, team work, presentations skills, topical challenges related to business strategy and operations.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 28h, self-study 44 h, group exercise 62h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:

Recommended optional programme components:
The students will complete 900062P Tuotantotalouden suullinen viestintä course simultaneously.

Recommended or required reading:
Lecture material. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilizes continuous assessment. Learning diary and participation in lectures, each group exercise in case solving and designing a case will be evaluated. 70% of the grade is based on group exercises.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
MSc Petteri Annunen

Working life cooperation:
No.

Other information:
Substitutes course 555284A roblem Solving in Business Cases.

555204A: Internship, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Practical training
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555210A Practice 3.0 op
ECTS Credits:
5 ECTS cr

Language of instruction:
Finnish.

Timing:
Periods 1-4.

Learning outcomes:
The objective is to familiarise students to industrial engineering and management in practical work life. During the course, students learn to observe his/her working environment from theoretical viewpoints of Industrial Engineering and Management (IEM). From the working environment, the student is able to identify IEM themes and classify them. The student is able to select theoretical references relevant for the topic and is able to evaluate the working environment based on the theoretical references. The student is able to draw up a report based on given instructions.

Contents:
To be defined by the student.

Mode of delivery:
Students will write a report concerning summer job. The length of the summer job has to be 2 months minimum.

Learning activities and teaching methods:
Students will write a report concerning summer job. Student’s personal teacher tutor will review and grade the report.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
-

Recommended optional programme components:
Report writing is integrated with the course 900061A Scientific Communication for Industrial Engineering and Management.

Recommended or required reading:
-

Assessment methods and criteria:
The Report.

Grading:
Fail/Pass

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
Yes

Other information:
Substitutes course 555210A Internship.

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555208M: Intermediate Studies in other Universities/Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuysikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish
555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

Vaiomassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

A440149: Module Preparing for the Major, Electronics and Communications Engineering, 40 op

Vaiomassaolo: 01.08.2015 -
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Common studies

521109A: Electrical Measurement Principles, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Christian Schuss
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits / 136h

Language of instruction:
Course is lectured in Finnish. Lecture notes are available in English. Laboratory exercises and the exam can be done in English.

Timing:
Periods 1-2.

Learning outcomes:
1. is able to measure basic measurements with a multimeter,
2. is able to measure basic measurements with an oscilloscope,
3. is able to operate signal and function generators.
4. is able to estimate the validity of their measurements.

Contents:
Units of measures, standards of measures, analysis of errors, most commonly used analog and digital measuring methods, equipment and electrical safety regulations.
Mode of delivery:
Pure face-to-face teaching.

Learning activities and teaching methods:
Lectures 20h, laboratory exercises 16 h and self-study 100h.

Target group:
Course is compulsory for electrical engineering, information engineering and wellness technology students. Course is open for all students in University of Oulu.

Prerequisites and co-requisites:
None.

Recommended optional programme components:
None.

Recommended or required reading:
Course material is in English and Finnish and can be found in Optima.

Assessment methods and criteria:
Exam and passed lab exercises. Read more about assessment criteria at the University of Oulu webpage.

Grading:
Grade is based on exam and grade is on numerical scale 1-5.

Person responsible:
Christian Schuss

Working life cooperation:
None.

Other information:

521302A: Circuit Theory 1, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Rahkonen, Timo Erkki
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
Finnish. Exams can be arranged in English on demand.

Timing:
Spring, period 4

Learning outcomes:
After the course the student can

1. write and solve the equations describing the operation of a given electrical circuit
2. solve the sinusoidal steady-state solution using complex phasor arithmetics
3. solve time responses of electric circuits
4. simplify electrical circuits e.g. using equivalent circuits
5. simulate simple circuits and choose an appropriate circuit simulation method
Contents:

Mode of delivery:
Classroom.

Learning activities and teaching methods:
30h lectures, 22h exercises, and a simulation exercise.

Target group:
Finnish BSc students.

Prerequisites and co-requisites:
Matrix algebra, complex arithmetics, differential equations.

Recommended optional programme components:
Background to all analog electronics courses.

Recommended or required reading:

Assessment methods and criteria:
Final exam. Also the simulation exercise must be passed
Read more about assessment criteria at the University of Oulu webpage.

Grading:
1-5

Person responsible:
Prof. Timo Rahkonen

Working life cooperation:
-

Other information:
-

521301A: Digital Techniques 1, 8 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Lahti
Opintokohteen kielet: Finnish
Leikkaavuudet:
521412A-02 Digital Techniques 1, Exercise Work 0.0 op
521412A Digital Techniques 1 6.0 op
521412A-01 Digital Techniques, Exam 0.0 op

ECTS Credits:
8

Language of instruction:
Finnish

Timing:
Periods 3-4

Learning outcomes:
1. After the course, students are able to ably binary number system and Boolean algebra in the form of switching algebra to the design and functional analyze of simple digital circuits.
2. In addition, they are also able to use in their designs graphical symbols specified in the dependency notation standard (SFS4612 ja IEEE/ANSI Std.91-1991) and different descriptions of function and structure of state machines.
3. Based on this knowledge, students are able to implement and analyze digital devices consisting of ordinary simple digital components.
4. After having assimilated the basic knowledge of digital technique, students are able to understand also the function and structure of micro controllers and micro processors.

Contents:
The principles of digital devices, Boolean algebra, numeral systems, operating principle, analysis and synthesis of combinational logic, flip-flops, operating principle, analysis and synthesis of sequential logic (state machines), physical characteristics of CMOS technology, registers and register transfers, computer memory, instruction set architecture, computer design basics, interfaces and data transmission.

Mode of delivery:
Classroom

Learning activities and teaching methods:
Lessons 40 h, weekly home assignments.

Target group:
Primarily 1st year electrical engineering and computer science and engineering BSc students. The course can be taken by the students of the university of Oulu.

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Text books, MIT OpenCourseWare and exercise literature.

Assessment methods and criteria:
Project work and home assignments
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Project work and home assignments are assessed on numerical scale 1-5. The average of project work and home assignments will be the final grade.

Person responsible:
Antti Mäntyniemi

Working life cooperation:
-

Other information:
-

Electronics

521077P: Introduction to Electronics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettaja: Jari Hannu
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay521077P Introduction to Electronics (OPEN UNI) 5.0 op
521209A Electronics Components and Materials 2.0 op
ECTS Credits:
5 ECTS credits / 132.5 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the 1st period. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:
1. Student understands the block structures of electronic devices and their signal processing paths.
2. Student can identify the interfaces of analog and digital electronics and the software operations.
3. Student is able to identify and classify electronics components and compare their properties.
4. Students can describe electric conductivity and apply the phenomenon on designing and choosing resistors.
5. Student is able to estimate the difference between dielectric materials and how they affect the properties of a capacitor.
6. Student can compare properties of magnetic materials and how identify they effect on inductive components.
7. Student can identify semiconductivity and is able to list typical semiconductor components.
8. Student can classify different circuit board techniques and is able to choose proper coupling techniques.
9. Student can identify the future technologies of electronics materials.

Contents:

Mode of delivery:
Face-to-face teaching and independent work.

Learning activities and teaching methods:
The implementation methods of the course vary. The course will be arranged utilizing activating teaching methods agreed on together with the students. There will be 48 hours of guided teaching events and 84.5 hours of teaching without guidance either privately or in a group.

Target group:
First year electrical engineering students.

Prerequisites and co-requisites:
No prerequisites.

Recommended optional programme components:
-

Recommended or required reading:
Lecture material; Materials science and engineering: an introduction / Willam D. Callister, chapters 1, 18 and 20; Electronic components and technology / S. J. Sangwine. Chapters 1, 2, 3, 5 and 7.

Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are two intermediate exams. In addition students will make course work which are graded. The assessment of the course is based on the learning outcomes of the course. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jari Hannu
Working life cooperation:
No
Other information:
-

**521104P: Introduction to Material Physics, 5 op**

**Opiskelumuoto:** Basic Studies  
**Laji:** Course  
**Vastuuysikkö:** Electrical Engineering DP  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Juha Hagberg, Jani Peräntie  
**Opintokohteen kielet:** Finnish

**ECTS Credits:**  
5 ECTS credits / 132.5 hours of work  
**Language of instruction:**  
Finnish.  
**Timing:**  
Autumn semester period 1  
**Learning outcomes:**  
1. is able to explain the principal solid state crystal structures  
2. can explain how propagating waves and electrons in a crystal lattice can be presented  
3. can explain the free electron model of metals and the formation of the energy band structure in crystals and their significance to the electrical properties of materials  
4. is able to explain the basic phenomena related to semiconductors and is able to calculate the charge carrier concentrations in them  

**Contents:**  
**Mode of delivery:**  
Will be notified in the beginning of lectures  
**Learning activities and teaching methods:**  
Will be notified in the beginning of lectures  
**Target group:**  
Second year electrical engineering students  
**Prerequisites and co-requisites:**  
Basic physics and mathematics.  
**Recommended optional programme components:**  
Basic course for 521071A Principles of Semiconductor Devices.  
**Recommended or required reading:**  
**Assessment methods and criteria:**  
Will be notified in the beginning of lectures.  
Read more about [assessment criteria](#) at the University of Oulu webpage.
Grading:
Will be notified in the beginning of lectures. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:
Juha Hagberg

Working life cooperation:
No

Other information:
-

521071A: Principles of Semiconductor Devices, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Hagberg, Jani Peräntie
Opintokohteen kielet: Finnish
Leikkaavuudet:
   521205A  Principles of Semiconductor Devices  4.5 op

ECTS Credits:
5 ECTS credits / 132.5 hours of work

Language of instruction:
Finnish

Timing:
Spring semester period 3

Learning outcomes:
1. will be able to explain physical phenomena in semiconductor materials and junctions; describe main types and characteristics of semiconductor diodes and transistors
2. will be able to explain physical principles of operation and to estimate ideal characteristics of the devices

Contents:

Mode of delivery:
Will be notified in the beginning of lectures.

Learning activities and teaching methods:
Spring term 2021, distance learning, Moodle and Zoom used. Moodle link will be send for students registered the course. First lecture 11.1.2021 at 14:15-16:00

Target group:
Second year electrical engineering students

Prerequisites and co-requisites:
521104P Introduction to materials physics.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Assessment methods and criteria:
Will be notified in the beginning of lectures. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Juha Hagberg

Working life cooperation:
No.

Other information:
-

521431A: Principles of Electronics Design, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Nissinen
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
Finnish.

Timing:
Spring, period 3

Learning outcomes:
1. should be able to analyze and design such electronic building blocks as rectifiers, clamping circuits, amplifiers and CMOS logic elements using diodes, operational amplifiers and MOS and bipolar junction transistors.

Contents:
Analogue and digital circuits, basic amplifier related concepts, diodes and diode circuits, single stage bipolar and MOS transistor amplifiers, small signal modeling and analyzing ac properties of amplifiers, internal structures of digital circuits (mainly CMOS), MOS/CMOS switch, operational amplifier.

Mode of delivery:
Remote teaching.

Learning activities and teaching methods:

Target group:
Students of Electrical engineering. Other students of the University of Oulu may also participate.

Prerequisites and co-requisites:
Circuit Theory I

Recommended optional programme components:
Recommended course Principles of Semiconductor Devices.

Recommended or required reading:
John Wiley & Sons 2015
Assessment methods and criteria:
Final or 2 mid-term exams.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5.

Person responsible:
Response responsible: Ilkka Nissinen
Lecturer: Juha Häkkinen
Assistant: Tuomo Talala

Working life cooperation:

521303A: Circuit Theory 2, 5 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Rahkonen, Timo Erkki
Opintokohteen kielet: Finnish
Leikkaavuudet:
521306A Circuit Theory 2 4.0 op

ECTS Credits:
5

Language of instruction:
Finnish

Timing:
Autumn, period 2

Learning outcomes:
After the course the student can:
1. use Laplace transform for solving time and frequency response of electric circuits;
2. derive continuous-time transfer functions.;
3. solve their poles and zeros and understand the meaning of those;
4. draw the pole-zero map and Bode plots of any given transfer function;
5. construct 2-port parameter models of a given circuit

Contents:
Use of Laplace transform in network analysis. Properties of network functions, poles and zeros, Bode magnitude and phase plots. 2-port parameter models.

Mode of delivery:
Classroom

Learning activities and teaching methods:
30h lectures, 22 h exercises, and simulation exercises.

Target group:
Finnish BSc students

Prerequisites and co-requisites:
Basics of circuit theory, differential equations.

Recommended optional programme components:
Continuation for Circuit theory 1. Needed in most analog electronics courses.

Recommended or required reading:

**Assessment methods and criteria:**
Final exam. Also the simulation exercise must be passed.
Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
Numerical 1-5

**Person responsible:**
Prof. Timo Rahkonen

**Working life cooperation:**

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*Wireless Communication*

**031077P: Complex analysis, 5 op**

- **Voimassaolo:** 01.08.2015 -
- **Opiskelumuoto:** Basic Studies
- **Laji:** Course
- **Vastuuysikkö:** Applied Mathematics and Computational Mathematics
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Jukka Kemppainen
- **Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- ay031077P  Complex analysis (OPEN UNI)  5.0 op
- 031018P  Complex Analysis  4.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
Fall semester, period 1.

**Learning outcomes:**
After completing the course the student
1. is able to calculate the derivative and the integral of functions of complex variable,
2. understands the concept of analyticity
3. is capable of calculating the contour integrals and using the theory of residues for computing the line integrals, will be able to apply the techniques of complex analysis to simple problems in signal processing.

**Contents:**
Complex numbers and functions, complex derivative and analyticity, complex series, Cauchy’s integral theorem, Laurent and Taylor expansions, theory of residues, applications to signal analysis.

**Mode of delivery:**
Face-to-face teaching, Stack(web-based too) exercises.

**Learning activities and teaching methods:**
Lectures 28 h/Exercises 14 h/Self study 93 h.

**Target group:**
The students in the engineering sciences. The other students are welcome, too.

**Prerequisites and co-requisites:**
The recommended prerequisite is the completion of the courses Calculus I and II, Differential Equations.

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
The lecture notes

**Assessment methods and criteria:**
Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Jukka Kemppainen

**Working life cooperation:**
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031080A: Signal Analysis, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Kotila, Vesa lisakki
Opintokohteen kielet: Finnish
Leikkaavuudet:

031050A  Signal Analysis  4.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish.
The course can be completed in English by a final exam.

**Timing:**
The course is held in the autumn semester, during period II. It is recommended to complete the course at the 2nd autumn semester.

**Learning outcomes:**
Upon completion of the course, the student:
- is able to calculate the energy, the power, the convolution and the frequency spectrum of discrete and analog, periodic and non-periodic deterministic signals
- is able to study the effect of sampling on the signal
- is able to calculate the Hilbert transform and the complex envelope of a signal
- is able to study the stationarity, the mutual dependence and the frequency content of random signals by means of the auto- and cross-correlation functions, and the power- and cross-power spectral densities
- is able to study the effect of an LTI system on a signal

**Contents:**

**Mode of delivery:**
The lectures and exercise classes will be arranged as distance learning via Zoom. The Zoom-links, directions and other material (in Finnish) will be made available in the Moodle-workspace for the course, which can be found at https://moodle.oulu.fi/course/view.php?id=5361

**Learning activities and teaching methods:**
Lectures 28 h / Exercises 14 h / Self-study privately or in a group 93 h. The independent work includes individual STACK-assignments as online work.

**Target group:**

- 

**Prerequisites and co-requisites:**
The recommended prerequisite is the completion of the courses 031078P Matrix Algebra, 031021P Probability and Mathematical Statistics and 031077P Complex Analysis.

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

**Assessment methods and criteria:**
The course is completed with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous assessment. The assessment of the course is based on the learning outcomes of the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Vesa Kotila

**Working life cooperation:**

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521330A: Telecommunication Engineering, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Electrical Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Kari Heikki Antero Kärkkäinen
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 521357A Basics of Analog Communications 3.0 op
- 521361A Basics of Digital Communications 3.0 op

**ECTS Credits:**
5 ECTS, equals 125 hours of student’s work

**Language of instruction:**
Finnish. The course can be completed in other languages e.g. in English as a book examination of specified pages of course book specified pages of course book shown below.

**Timing:**
The course is lectured on period 4. Recommended for second study year.

**Learning outcomes:**
1. can tell and explain the essential blocks and their operation in time & frequency domains for frequently used analog and digital carrier and pulse modulation methods.
2. understands essential differences both between linear and non-linear modulations, and between coherent and non-coherent modulations.
3. understands in which system applications each analog or digital modulation is typically used.
4. can tell limitations on system performance caused by noise interference and various transmission channels, and can propose methods to suppress interference both in analog and digital transmission.
5. can perform system analysis, and can calculate performances of analog and digital modulations based on simple assumptions regarding channel models.
6. can compare modulations from the standpoints of resource use (transmitted power and bandwidth needed) and implementation complexity.
7. understands the meanings of various equalizing, diversity and coding methods from the standpoint of improvement for digital transmission reliability.
8. understands various standards and specifications of new digital transmission systems.
9. can apply gained knowledge in working life to design of systems and their sub-system units, and can also perform computer simulations.
10. understands the principles of information theory, source coding and error-control coding, and masters various most commonly used coding methods.

Contents:

Mode of delivery:
Distance learning teaching with Zoom lectures on spring 2021.

Learning activities and teaching methods:
Online teaching 52 h (Zoom). No separate times for class-exercises. Exercises have been integrated as part of face-to-face teaching event. Self-study 73 h. Total 125 h.
The lectures are keep as distance lectures by Zoomin and links to them will be distributed in March on the Moodle course page.

Target group:
Second year B.Sc.(Tech.) students both in electronics and telecommunication engineering (ECE) degree programme, and in some specialization options of computer science and engineering (CSE) degree programme.

Prerequisites and co-requisites:
031080A Signal analysis course.

Recommended optional programme components:
No connections to other courses.

Recommended or required reading:

Assessment methods and criteria:
Course can be passed either with four mid-term exams, or with final exam. Course does not contain discrete exercise work. Candidate-level course 521329A Hands-on course in wireless communications is recommended to be taken on 3rd study year as a sequel for this course to practice modulation principles in real life using NI USRP-2900 software radio platform.

1st midterm exam Thursday, March 25, 2021 from 10:15 a.m to 12:00 p.m. The Moodle distance exam will appear in the spring of 2021 to the Moodle course page.

2nd midterm exam Thursday, April 8, 2021 from 10:15 a.m to 12:00 p.m. The Moodle distance exam will appear in the spring of 2021 to the Moodle course page.
3rd midterm Thursday, April 22, 2021 from 10:15 a.m to 12:00 p.m. The Moodle distance exam will appear in the spring of 2021 to the Moodle course page.

4th midterm exam Thursday, May 6, 2021 from 10:15 a.m to 12:00 p.m. The Moodle distance exam will appear in the spring of 2021 to the Moodle course page.

Final exam Thursday 20.5.2021 from 4:15 p.m. -7:15 p.m. Moodle distance exam will be published in the spring of 2021 to the Moodle course page.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:
Kari Kärkkäinen

Working life cooperation:
No

Other information:
This course replaces the following candidate level courses: 521357A Telecommunication Engineering I (3 ECTS) and 521361A Telecommunication Engineering II (3 ECTS).

The course uses the Moodle environment:
https://moodle.oulu.fi/course/view.php?id=691

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521329A: Hands-on Course in Wireless Communication, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Kari Heikki Antero Kärkkäinen
Opintokohteen kielet: Finnish
Leikkaavuudet:
  521316A  Broadband Communications Systems  4.0 op

ECTS Credits:
5 ECTS, equals 125 hours of student’s work

Language of instruction:
Finnish

Timing:
The course is organized in the autumn semester during the 1st period. It is recommended to complete the course at the 3rd year autumn semester.

Learning outcomes:
After completing course a student
1. is acquainted with the principles of universal software radio peripheral (USRP) technologies and their implementation and understands the basic idea of software radio concept. That is obtained with the aid of small laboratory exercise work tasks which require understanding theories of basic analog and digital carrier modulation methods learned before this course.
2. understands the idea of complex-valued I&Q vector-signals, which exist behind software radios and measurement techniques, and understands how such signals are linked to real-valued RF-signals.
3. has learned how to use universal software radio peripheral transceivers, and how to observe them in laboratory environment. Student also understands how to control these FGPA-based (field-programmable gate array) devices with the aid of control software platforms (e.g. Matlab-Simulink, LabVIEW, GNU Radio) and understands their limitations in real engineering work.
4. has implemented and tested various basic modulation methods both in radio channel and coaxial cable channel, and has made real observations and measurements in time-frequency domain using USRP control software.
5. has learned to find and deduct radio signal spectras and time waveforms with the aid of time-frequency analysis.
6. can test and model in laboratory environment during course and later in work life various problems and solutions dealing with wireless communication before construction of a prototype device.

Contents:

Students are introduced to the wireless communication systems and their phenomena with the aid of guided laboratory exercises. The course utilizes National Instruments USRP-2900 universal software radio peripheral tranceiver.

Mode of delivery:

Face-to-face contact teaching for theory lectures and guided laboratory exercises in a classroom. Self-studying at home between work themes of each week. Writing of exercise work report for each conducted work task.

Learning activities and teaching methods:

Course consist of small wireless communication tasks using various analog and digital carrier modulations. Total number of exercise works is 8. The course utilizes mainly National Instruments USRP-2900 universal software radio peripheral tranceiver which is controlled via laptop computer’s USB connection. Transmission and receiving of I&Q signals are controlled with Matlab. Students are required to have competent laptop with Matlab-Simulink campus licence. Students have to participate in short briefing lectures. Exercise works are done by a group of 2 students. Results are summarized in a written report for each task according to given instructions. Students have to return report two weeks after each work session.

Course contains 14 hours lectures for work instructions and 32 hours of measurement work. In addition, students perform 79 hours of self-study and reporting at home. Total 125 hours.

Target group:

Third year bachelor level students in electronics and communications engineering degree programme.

Prerequisites and co-requisites:

031080A Signal analysis and 521330A Telecommunication engineering

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

No course book. Lecture slides, and problem assignments together with work instruction are given during the course. Materials will be placed into Moodle environment. In addition, some NI USRP-2900 related material will be placed into Moodle.

Assessment methods and criteria:

All students of a group have to participate in introductory face-to-face teaching and briefing lecture, and will prepare a final report according teacher’s instructions. Before student’s mandatory absence, a student has to negotiate that with a teacher. Participation in all introductory lectures and laboratory exercises is mandatory for all members of a group. Presence of each student is monitored by a teacher. In addition, final report has to be in form required by a course teacher, and the content has to be satisfying from acceptance standpoint. Course does not contain final exam.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

Course grading is done with the numbers 0…5. Grade 0 is interpreted as failed. Student group has to get acceptable number of points for each task. Final grade is based on the total number of points from each sub-work theme using standard rounding techniques.

Person responsible:

Kari Kärkkäinen

Working life cooperation:

No

Other information:
521337A: Digital Filters, 5 op

Opiskelumoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Olli Silven
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay521337A    Digital Filters (OPEN UNI)    5.0 op

ECTS Credits:
5 ECTS cr

Language of instruction:
Finnish, English study material available

Timing:
Spring, period 3.

Learning outcomes:
1. Student is able to specify and design respective frequency selective FIR and IIR filters using the most common methods.
2. Student is able to solve for the impulse and frequency responses of FIR and IIR filters given as difference equations, transfer functions, or realization diagrams, and can present analyses of the aliasing and imaging effects based on the responses of the f
3. Student is able to explain the impacts of finite word length in filter design.
4. Student has the necessary basic skills to use signal processing tools available in Matlab environment and to judge the results.

Contents:

Mode of delivery:
Online teaching (Lectures), independent work, group work

Learning activities and teaching methods:
Online lectures and exercises 50 h. The design exercises familiarize the students with the methods of digital signal processing using the Matlab software package. The rest as independent work.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
031077P Complex Analysis, 031080A Signal Analysis

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course can be passed either with week exams or a final exam. In addition, the exercises need to be returned and accepted.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Olli Silven

Working life cooperation:
None.

Other information:
Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi. Open University students enroll for studies through an open website.

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

A440146: Module Preparing for the Major, Medical and Wellness Technology, 40 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Biomedical Engineering

080901A: Introduction to Technology in Clinical Medicine, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Jämsä, Timo Jaakko
Opintokohteen kielet: Finnish

Proficiency level:
-
Status:
-
Required proficiency level:
-
ECTS Credits:
5 ECTS, 135 hours of work
Language of instruction:
Finnish

Timing:
Bachelor or Master studies, autumn term, 1\textsuperscript{st} and 2\textsuperscript{nd} periods

Learning outcomes:
The student can identify technologies in different fields of clinical medicine, can describe operating principles behind these technologies and evaluate the advantages and limitations of the technologies.

Contents:
Course introduction lectures. Specialists from different clinical areas give lectures and demonstrations, in which main themes and terms of the field are introduced and technical methods and development needs are presented.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Initial exam. Lectures, demonstrations, course assignment and self-study. Final exam which is based on lectures and all given materials.

Target group:
Students of medical and wellness technology, information technology, electrical engineering, mechanical engineering, industrial engineering and management, physics or of other related degree programmes interested in biomedical engineering and medical technologies.

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
The material addressed during the lectures.

Assessment methods and criteria:
Initial exam with multiple-choice questions. Taking part in the lectures and demos. Learning assignment. Final exam, which includes essays. Before participation in the final exam, the student must complete and pass the initial exam and learning assignment.
Read more about \url{assessment criteria} at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5 or fail. Grading is based on the final exam.

Person responsible:
Professor Timo Jämsä

Working life cooperation:
The course will be mainly organized in the hospital, and lectures are given by clinical specialists.

Other information:
-

764163P: Introduction to Biomedical Physics, 5 op
Introduction to Biomedical Physics (part 1)  0.0 op
Basic biophysics (part 2)  0.0 op
Introduction to biophysics  2.0 op
Introduction to biophysics  3.0 op

ECTS Credits:
5 ECTS credits

Language of instruction:
Finnish

Timing:
1st spring

Learning outcomes:
Student can describe and explain some basics and concepts of certain areas of biomedical physics and knows central research targets and methods of biomedical physics.

Contents:
The course provides an introduction to biomedical physics from the point of views of biosciences and medical physics, and introduces basics of research and recording methods of the field, biophysical models, biosystems analysis, cellular and biomolecular physics, physics of fluids and their flow, and some other special issues. The course includes also a short introduction to some fields of physics that are of particular and occupational interest to medical physicists.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 36 h, self-study 96 h, final exam

Target group:
Mainly students in Physics B.Sc. program.
Also for the other students of the University of Oulu.

Prerequisites and co-requisites:
No specific prerequisites.

Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously.

Recommended or required reading:
Lectures and lecture notes

Assessment methods and criteria:
Exam

Grading:
Numerical grading scale 0 – 5, where 0 = fail

Person responsible:
Kyösti Heimonen

Working life cooperation:
No work placement period

521109A: Electrical Measurement Principles, 5 op
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Christian Schuss
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits / 136h

Language of instruction:
Course is lectured in Finnish. Lecture notes are available in English. Laboratory exercises and the exam can be done in English.

Timing:
Periods 1-2.

Learning outcomes:
1. is able to measure basic measurements with a multimeter,
2. is able to measure basic measurements with an oscilloscope,
3. is able to operate signal and function generators.
4. is able to estimate the validity of their measurements.

Contents:
Units of measures, standards of measures, analysis of errors, most commonly used analog and digital measuring methods, equipment and electrical safety regulations.

Mode of delivery:
Pure face-to-face teaching.

Learning activities and teaching methods:
Lectures 20h, laboratory exercises 16 h and self-study 100h.

Target group:
Course is compulsory for electrical engineering, information engineering and wellness technology students. Course is open for all students in University of Oulu.

Prerequisites and co-requisites:
None.

Recommended optional programme components:
None.

Recommended or required reading:
Course material is in English and Finnish and can be found in Optima.

Assessment methods and criteria:
Exam and passed lab exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Grade is based on exam and grade is on numerical scale 1-5.

Person responsible:
Christian Schuss

Working life cooperation:
None.

Other information:

080925A: Anatomy and Physiology for Biomedical Engineering, 5 op
Voimassaolo: 01.08.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

Proficiency level:
-
Status:
-
Required proficiency level:
-
ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English
Timing:
Master studies, autumn term 1st period – THE COURSE WILL BE ORGANIZED NEXT TIME IN AUTUMN 2021

Learning outcomes:
-
Contents:
-
Mode of delivery:
-
Learning activities and teaching methods:
-
Target group:
-
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
-
Grading:
-
Person responsible:
University lecturer Mikko Finnilä
Working life cooperation:
-
Other information:
THE DESCRIPTION WILL BE UPDATED FOR STUDY GUIDE 2021-2022
031077P: Complex analysis, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Kemppainen
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay031077P  Complex analysis (OPEN UNI)  5.0 op
  031018P  Complex Analysis  4.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
Fall semester, period 1.

Learning outcomes:
After completing the course the student
1. is able to calculate the derivative and the integral of functions of complex variable,
2. understands the concept of analyticity
3. is capable of calculating the contour integrals and using the theory of residues for computing the line integrals, will be able to apply the techniques of complex analysis to simple problems in signal processing.

Contents:
Complex numbers and functions, complex derivative and analyticity, complex series, Cauchy’s integral theorem, Laurent and Taylor expansions, theory of residues, applications to signal analysis.

Mode of delivery:
Face-to-face teaching, Stack(web-based too) exercises.

Learning activities and teaching methods:
Lectures 28 h/Exercises 14 h/Self study 93 h.

Target group:
The students in the engineering sciences. The other students are welcome, too.

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the courses Calculus I and II, Differential Equations.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time

Recommended or required reading:
The lecture notes

Assessment methods and criteria:
Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:
Jukka Kemppainen

Working life cooperation:
031080A: Signal Analysis, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Kotila, Vesa Iisakki
Opintokohteen kielet: Finnish
Leikkaavuudet:

031050A  Signal Analysis  4.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish.
The course can be completed in English by a final exam.

Timing:
The course is held in the autumn semester, during period II. It is recommended to complete the course at the 2nd autumn semester.

Learning outcomes:
Upon completion of the course, the student:
- is able to calculate the energy, the power, the convolution and the frequency spectrum of discrete and analog, periodic and non-periodic deterministic signals
- is able to study the effect of sampling on the signal
- is able to calculate the Hilbert transform and the complex envelope of a signal
- is able to study the stationarity, the mutual dependence and the frequency content of random signals by means of the auto- and cross-correlation functions, and the power- and cross-power spectral densities
- is able to study the effect of an LTI system on a signal

Contents:

Mode of delivery:
The lectures and exercise classes will be arranged as distance learning via Zoom. The Zoom-links, directions and other material (in Finnish) will be made available in the Moodle-workspace for the course, which can be found at https://moodle.oulu.fi/course/view.php?id=5361

Learning activities and teaching methods:
Lectures 28 h / Exercises 14 h / Self-study privately or in a group 93 h. The independent work includes individual STACK-assignments as online work.

Target group:

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the courses 031078P Matrix Algebra, 031021P Probability and Mathematical Statistics and 031077P Complex Analysis.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
**Assessment methods and criteria:**
The course is completed with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous assessment. The assessment of the course is based on the learning outcomes of the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Vesa Kotila

**Working life cooperation:**
-

**041201A: Basics in eHealth, 5 op**

**Voimassaolo:** 01.08.2011 -
**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Medicine

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jarmo Reponen

**Opintokohteen kielet:** English

**Leikkaavuudet:**
ay041201A Basics in eHealth (OPEN UNI) 5.0 op

**ECTS Credits:**
5 ECTS cr, 135 hours of work

**Language of instruction:**
English
(native Finnish speakers are allowed to write their essay in Finnish)

**Timing:**
The main course for students of the (Master's) degree programmes is held in the spring semester, 3rd period. This course is meant also for exchange students of the Biomedical Engineering programme.
The special edition course is held for exchange students of the Faculty of Medicine (medicine, health sciences) in the autumn semester, 2nd period. Other students can participate in this course depending on availability of free places (limited number of places).

**Learning outcomes:**
Upon completion of the course:
The student can define central information and communication technology (ICT) terms and solutions in healthcare, and can list respective applications in healthcare services and training.
The student can evaluate the societal and economic significance of information and communication technology in healthcare.
The student can understand the position of e-health and telemedicine solutions as a part of the national health care information system.
The student receives an initial view of future health ICT trends from clinical perspective and possibilities to contribute to these with his/her professional background.

**Contents:**
Terms and concepts
- societal dimensions
- delivery of health services
- electronic patient records
- data transfer within the health care system
- data transfer between the health care professionals and the citizens
- citizens providing their own health data, mHealth-solutions
- national healthcare information exchange in Finland
- remote consultations, examples like teleradiology, telepsychiatry, telerehabilitation
- economical and functional assessment
- remote education in health care
- future visions of health care information systems
- changing current topics in connected health like: artificial Intelligence, knowledge based medicine, cybersecurity etc according to availability
- Most presented examples in the course are based on information system installations in Northern Finland

Mode of delivery:
Web-based teaching

Learning activities and teaching methods:
Interactivity takes place in virtual learning environment Moodle. The course consists of videotaped lectures, power point presentations and links to other material available in the web. Performance of duties includes an essay, exam, participating in moderated discussions on the grounds of the lectures.
Web lectures 15h / Web exams 40h / Written tasks/ essay 40h* / Self-study and participation in web discussion 40h
(*Exchange students can relate their essay to the situation in their home countries)

Target group:
MSc and 3rd year BSc students of degree programmes in medical and wellness technology, biomedical engineering, biophysics, physics, and other degree programs; students of medicine and health sciences and everyone who is interested. Please, note the recommended separate course timings for different groups.

Prerequisites and co-requisites:
None

Recommended optional programme components:
The course is independent and does not require additional studies carried out at the same time.

Recommended or required reading:
All recommended or required reading is offered in the Moodle virtual learning environment or in linked web pages.

Assessment methods and criteria:
Web tasks, contribution to moderated discussion, an essay and course exams and optional final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0 – 5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Jarmo Reponen
Course teacher Nina Keränen, MD, MSc
Course teacher Anna Maijala MSc

521124S: Electronic Sensors, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Aliaksandr Bykau, Alexey Popov
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
English.

Timing:
Learning outcomes:
After the course the student is capable to explain the operating principles of different sensors and can select a right sensor for each measuring target. He/she is able to quantify the requirements that affect sensor selection as well as recognize and evaluate the uncertainty of a measurement. In addition the student is able to plan and design sensor signal conditioning circuits.

Contents:
Methods for measuring displacement, velocity, acceleration, torque, liquid level, pressure, flow, humidity, sound and temperature. Ultrasound, optical and nuclear measurement techniques and applications, material analyses such as pH measurement and gas concentration, pulp and paper measurements and smart sensors.

Mode of delivery:
Pure face-to-face teaching.

Learning activities and teaching methods:
Lectures 26h, exercises 12h and self-study 100h.
The information about the course 521124S - Anturit ja mittausmenetelmät/Electronic Sensors has been added to the Moodle page:
https://moodle.oulu.fi/course/view.php?id=5357

Course description: "The course is aimed at students willing to be capable of explaining the operating principles of different sensors and selecting the right sensor for each measuring target. We will focus on how to quantify the requirements that affect sensor selection as well as recognize and evaluate the uncertainty of a measurement. In addition, we will go into questions on how to plan and design sensor signal conditioning circuits."

The lectures and seminars will be organized remotely via Zoom environment. The corresponding link will be published on the page of the course in Moodle prior to the lecture.

Target group:
4 year students.

Prerequisites and co-requisites:
No.

Recommended optional programme components:
No.

Recommended or required reading:

Assessment methods and criteria:
The course is passed by a final exam and passed exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
1-5

Person responsible:
Aliaksandr Bykau ja Alexey Popov

Working life cooperation:
No.
Opintokohteen kielet: Finnish

A440147: Module Preparing for the Major, Software Engineering, 40 op

Voimassaolo: 01.08.2015
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Common studies: 521145A or 811177P

521145A: Human-Computer Interaction, 5 op

Voimassaolo: 01.08.2012
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Simo Hosio
Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr

Language of instruction:
Finnish/English

Timing:
Autumn semester, Period II

Learning outcomes:
Upon completing this course, students will possess:
1. Knowledge of Human Computer Interaction (HCI) fundamentals
2. Knowledge and practical experience of user-centric computer interface and usability evaluation techniques, such as questionnaires and interviewing
3. Knowledge and experience of prototyping techniques (both paper-based as well as digital)
4. Knowledge of how HCI can be incorporated in the software development process

Contents:
Fundamental knowledge of humans, and how that relates to computer systems and interfaces. Learning design in 2-3 different ways, and conducting evaluations of the designs. Evaluation constitutes data collection and analysis, including qualitative and quantitative data.

Mode of delivery:
Online teaching (lectures), group work (labs).

Learning activities and teaching methods:
Lectures (12 h), exercises (16 h), and practical work (105 h). The course is passed with approved classroom/reading package reflections, and an approved group-based practical work (several assignments). The implementation is doable fully in English.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
While no specific courses are not required, elementary teamwork skills are required and the capability to provide documentation.

**Recommended optional programme components:**
All necessary material will be provided by the instructor.

**Recommended or required reading:**
No required reading.

**Assessment methods and criteria:**
The course completion relies on completed solo-work (reflections), and the numerical assessment is project-based. Students have to complete several individual exercises throughout the semester: ideating an application, designing various versions of its prototype, evaluating those prototypes, documenting the final application designs. Passing criteria: all stages of the project-based work must be completed, each receiving more than 50% of the available points.

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Associate Professor Simo Hosio

**Working life cooperation:**
If relevant, guest lectures may be organized (optional).

**Other information:**
Using Moodle as the teaching platform: https://moodle.oulu.fi/course/view.php?id=5409

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**811177P: Humans as Users and Developers of Information Technology, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuysikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Arhippainen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
  ay811177P  Humans as Users and Developers of Information Technology (OPEN UNI)  5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is not lectured anymore, because it is not part of the new curriculum. However, it can be taken as a self-study course during the academic year 2020-2021. In that case, contact the responsible teacher. Later, if the course is obligatory in your degree programme structure, it must be replaced with another course. In that case, contact your tutor teacher or academic affairs.

**Learning outcomes:**
After completing the course, the student is able to:

* examine humans as both users and developers of information technology,
* explain core concepts of the phenomenon, and understands their meaning in relation to practice, as well as
* describe the background of usability research and some of its scientific theories.

**Contents:**
The key themes and concepts of the course are the diversity of information technology, humans as users and developers of information technology, usability, use and user experience, user-centred design and service design.
Mode of delivery:
Independent study

Learning activities and teaching methods:
Digital learning material and selected readings (133h).

Target group:
BSc students

Recommended or required reading:
Antti Oulasvirta (ed.): "Ihmisen ja tietokoneen vuorovaikutus" (2011), osat I ja II. In addition, digital material in Moodle learning environment.

Assessment methods and criteria:
Digital proof of learning. Assessment criteria will be given together with assignments.

Grading:
Numerical scale 1-5 or fail

Person responsible:
Tonja Molin-Juustila

812363A: Human-Centred Design, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Netta Iivari
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 2nd autumn semester of the Bachelor's studies. The course is not implemented in Academic year 2020-2021.

Learning outcomes:
After completing the course, the student will be able to:
* describe the principles and central concepts of human-centered design,
* identify the basic phases and central analysis, design and evaluation methods of human-centered design,
* apply the method in user interface design from the perspective of specific user group and system,
* describe the significance and design of user support,
* describe the significance of usability, accessibility and universal design, as well as
* identify variety involved in human-centered design

Contents:
The principles and central concepts of human-centered design, the basic phases and central analysis, design and evaluation methods of human-centered design, user support, usability, accessibility, universal design, variety involved in human-centered design

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures, exercises, groupwork, individual assignments, seminar

Target group:
BSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Information Systems Modelling, Design and Development.

**Recommended or required reading:**

**Assessment methods and criteria:**
During the course, the students will be carrying out a groupwork assignments and individual tasks. These will be assessed based on the learning outcomes of the course. The assessment criteria and the requirements will be explained in detail during the opening lecture of the course.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Netta Iivari

**Working life cooperation:**
Guest lectures

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**Common studies**

**811379A: Basics of Human Computer Interaction, 5 op**

| Opiskelumuoto: Intermediate Studies |
| Laji: Course |
| Vastuuysikkö: Information Processing Science DP |
| Arvostelu: 1 - 5, pass, fail |
| Opettajat: Helena Tokkonen |
| Opintokohteen kielet: Finnish |

**Leikkaavuudet:**
- ay811379A Basics of Human Computer Interaction (OPEN UNI) 5.0 op
- 812327A Introduction to HCI design 4.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course at the 2nd autumn semester of the Bachelor's studies.

**Learning outcomes:**
Upon completion of the course, the student will be able to define basic concepts of user interface design, introduce basic design process with design and evaluation methods and tasks, and apply graphical user interface design from the viewpoint of a certain user group and system.

**Contents:**
Basic concepts of user interface design and usability evaluation; user-centred design process; gathering of user data, analysis, expert evaluation and design by prototyping, user-based evaluation; universal design and user support; user interface description.

**Learning activities and teaching methods:**
Lectures 20 h, guided group assignment tasks in exercises 21 h and without guidance in assignment groups 58 h; seminar 3 h; individual tasks 31 h

**Target group:**
BSc students
Prerequisites and co-requisites:
Humans as Users and Developers of Information Technology (811177P) -course or related knowledge.

Recommended or required reading:
Dix et al. (2003, third or later edition) Human-Computer Interaction, lectures in Moodle and excercises material.

Assessment methods and criteria:
During the course, the students will be compiling the group assignments and individual integration tasks on their implementation. These will be assessed based on the learning outcomes of the course. The assessment criteria and the requirements will be explained in detail during the opening lecture of the course.

Grading:
Numerical scale 1-5 or fail

Person responsible:
Helena Tokkonen

Other information:
Kurssin aloitusluento 26.10 klo 12.15 -14.00 (Zoom: https://oulu.zoom.us/j/3613543762, meeting ID: 361 354 3762)

Kurssiavain Moodle-ympäristöön: KLP2020 (Kurssi avautuu 20.10.)

811168P: Information Security, 5 op

Voimassaolo: 01.08.2010 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Tero Päivärinta
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay811168P Information Security (OPEN UNI) 5.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work.

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester of the Bachelor's studies.

Learning outcomes:
After completing the course, the student will be able to:
* define essential information security concepts and components of information systems security,
* recognize the common types of security threats, and their managerial and technical protection mechanisms,
* describe the tasks and responsibilities of information security professionals,
* explain the different phases of secure systems development/acquisition,
* recognize the fundamental characteristics of risk management and evaluate information security risks,
* recognize basics of technical information security methods and cryptography, as well as
* explain areas of behavioral information security research and their practical implications.

Contents:
* Basic concepts of information security
* Information security threats, vulnerabilities, and risks
* Legal issues and information security frameworks
* Risk management
* Cryptography
* Information security technologies
* Behavioral information security research

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures and related quizzes or final exam 26 h, weekly assignments and scientific essay 107 h

**Target group:**
BSc students.

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished:
Introduction to Information Processing Science as well as Devices and Data Network

**Recommended optional programme components:**

**Recommended or required reading:**

**Assessment methods and criteria:**
Weekly assignments. Group or individual assignment.

**Grading:**
Numerical scale 1-5 or fail.

**Person responsible:**
Tero Päiväranta

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**811391A: Requirements Engineering, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Markus Kelanti

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
ay811391A Requirements Engineering (OPEN UNI) 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work.

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course in the 1st spring semester of the Bachelor's studies.

**Learning outcomes:**
After completing the course, the student will be able to:
* apply requirements engineering skills and techniques individually and in teams, and understands the requirements fundamentals,
* choose and apply some of the requirements elicitation techniques,
* choose and apply some of requirements specification and documentation techniques, as well as
* apply appropriate requirements validation techniques, as well as learn new requirements engineering methods and techniques.

**Contents:**
* Requirements traceability
* Different stakeholder viewpoints and requirement categories
* Requirements change
* Problem structuring methods
* Requirements engineering skills and techniques in iterative development environment
* Requirements identification, elicitation, specification and documentation techniques
* Requirements prioritization and validation techniques

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures and exercises 32h; independent work, group project and individual work 101h. Alternatively, independent study and book exam 133h.

**Target group:**
B.Sc. students.

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Introduction to Software Engineering

**Recommended optional programme components:**

**Recommended or required reading:**

**Assessment methods and criteria:**
Active participation (lectures, weekly assignments, group project and individual project), or alternatively book exam

**Grading:**
Numerical scale 1-5 or fail.

**Person responsible:**
Markus Kelanti

**Working life cooperation:**
Guest lectures

*Common: 521457A tai 811346A*

**521457A: Software Engineering, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Computer Science and Engineering DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Juha Röning

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay521457A Software Engineering (OPEN UNI) 5.0 op

**ECTS Credits:**
5

**Language of instruction:**
Finnish. Material available in English.

**Timing:**
Spring, period 3.

**Learning outcomes:**
1. After finishing the course, the student knows the basic concepts of software engineering.
2. The student also knows the different areas of project management, the phases of software development.
3. The student can define goals and tasks for each phase of development.
4. The student knows the principles of secure software development.
5. The student knows the metrics used in software engineering and is able to apply them.
6. The student is familiar with tools commonly used in software engineering.

**Contents:**
Problems of software development and the special features of real-time systems in this regard. Software development is viewed in regard to project management and actual implementation: 1. process models, 2. requirements specification, 3. project management basics: design, metrics, risk management, resource management, follow up, quality control, product control, 4. software testing methods and strategies, 5. introduction to object-oriented analysis and design. 6. Agile software development. 7. Secure software engineering.

**Mode of delivery:**
Online course.

**Learning activities and teaching methods:**
The course consists of lectures and independent practical exercises. The course is completed by a final exam or learning diaries and successfully completed practical exercises. Lectures 30 h, laboratory design (in period 3) 8 h, the rest of the self-study.

**Target group:**
Computer Science and Engineering students and other Students of the University of Oulu.

**Prerequisites and co-requisites:**

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

**Assessment methods and criteria:**
Final exam and accepted laboratory exercise. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Juha Röning

**Working life cooperation:**
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**811346A: Software Engineering, 5 op**

- **Voimassaolo:** 01.08.2015 -
- **Opiskelumuoto:** Intermediate Studies
- **Laji:** Course
- **Vastuuysksikkö:** Information Processing Science DP
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Lappalainen, Jouni Esko Antero
- **Opintokohteen kielet:** Finnish
- **Leikkaavuudet:**

**ECTS Credits:**
5 ECTS credits / 133 hours of work
Language of instruction:
Finnish

Timing:
The course is not lectured anymore, because it is not part of the new curriculum. However, it can be taken as a self-study course during the academic year 2020-2021. In that case, contact the responsible teacher. Later, if the course is obligatory in your degree programme structure, it must be replaced with another course. In that case, contact your tutor teacher or academic affairs.

Learning outcomes:
After completing the course, a student
* is able to explain various aspects of software engineering areas such as process models, requirement specification, analysis and design methods, quality management and project management, their importance and know how to use them for small-scale task solving.
* is familiar with software engineering practices and activities (review, testing, software product management, risk management, project management) and knows how to use them in software development at different levels.
* can explain the maintenance and redesign of software evolution and its importance.

Contents:
Software process, software requirements, software design methods, software engineering practices, software quality management, software project management

Mode of delivery:
Self-study

Learning activities and teaching methods:
Essay 60 h and self-study 80 h

Target group:
BSc students

Prerequisites and co-requisites:
Course Introduction to Information Systems Design and Object Oriented Analysis and Design or similar knowledge.

Recommended or required reading:

Assessment methods and criteria:
Essay and assignment.

Grading:
Numerical scale 1-5 or fail

Person responsible:
Jouni Lappalainen

Software production

811174P: Introduction to Software Business, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Marianne Kinnula
Opintokohteen kielet: Finnish
Leikkaavuudet:

811178P Technology Business and Innovations 5.0 op
ay811174P Introduction to Software Business (OPEN UNI) 5.0 op
ECTS Credits:
5 ECTS credits / 133 hours of work.

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 1st spring semester of the Bachelor's studies.

Learning outcomes:
After completing the course, a student will be able to:
* explain how the industry is structured;
* describe the software industry's business logic as typically used in business models and the reasoning behind their use;
* describe the important areas of the software business; as well as
* describe legal issues related to software business.

Contents:
This course provides an overview of software business from three different viewpoints: software industry, business logic, and functions of a software company.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Blended teaching 100 h, home essay 30 h

Target group:
BSc students.

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses are accomplished: Introduction to Information Processing Science

Recommended optional programme components:
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Recommended or required reading:
Course material and related literature.

Assessment methods and criteria:
Assignments, take home examination.

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Marianne Kinnula

811104P: Programming 1, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Lappalainen, Jouni Esko Antero
Opintokohteen kielet: Finnish
Leikkaavuudet:
   ay811104P  Programming 1 (OPEN UNI)  5.0 op
   811122P  Introduction to Programming  5.0 op
ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester of the Bachelor's studies.

Learning outcomes:
After completion of this course, the student will be able to:
* create simple working programs
* identify and use the basic control structures of a program.
* identify the concepts of modularity, table, storage of information.
* apply the concepts of modular structure, tables and information storage techniques into a program.
* find and fix errors in the program.
* solve a computational problem by using abstraction and stepwise refinement
* explain the concept of recursion.
* operate with binary and hexadecimal number systems, as well as knows the presentation of numbers on a computer.
* document the program.

Contents:

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Theory studies at lectures and/or online (in Finnish) 40h, programming exercises in a computer lab and/or an online learning environment 24h, self-study 70h

Target group:
BSc students

Recommended or required reading:
Deitel, Deitel: C HOW TO PROGRAM; Pearson Education Inc. 2007, or a newer edition. Lecture slides.

Assessment methods and criteria:
1. Final exam and exercise points and programming assignment. OR 2. Mid-term exams (2) and exercise points and home programming assignment.

Grading:
Numerical scale 1-5 or fail

Person responsible:
Jouni Lappalainen

Information Systems

811167P: Introduction to Information Systems Design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Mikko Rajanen
Opintokohteen kielet: Finnish
Leikkaavuudet:
ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd autumn semester of the Bachelor's studies.

Learning outcomes:
After completing the course, the student will be able to Explain the main areas of the information system design on technical level, main design process models for the information system design, basics of the requirement gathering, basics of the information system initialization, and basics of how to evaluate information systems.; Produce use-case descriptions, use-case diagrams and other types of diagrams and descriptions needed to model the operational environment of the information system.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 27 h, exercises 21 h, assignment 85 h, exam 3 h.

Target group:
BSc students

Recommended or required reading:

Assessment methods and criteria:
Exam and mandatory assignment

Grading:
Numerical scale 1-5 or fail

Person responsible:
Mikko Rajanen
Timing:
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 1st year autumn semester of the Bachelor's studies.

Learning outcomes:
After completing the course, the student will be able to:
* use basic concepts of information systems,
* recognize challenges regarding the use of information systems and users,
* describe the basics of organisation, e.g. its structure and function,
* recognize different types of information systems and their roles in an organisation,
* describe how organizational knowledge is formed and recognizes challenges of managing it,
* recognize ethical and social challenges related to information systems,
* describe the role of information systems in leadership and decision making,
* recognize the possibilities of information systems renewal and financial impact of it, as well as
* describe the basics of the history of information systems discipline, its research methods and scientific journals.

Contents:
* Basic terms and concepts of information systems.
* Challenges regarding the use of information systems and its users.
* Basics of organisation.
* Types of information systems and their roles in an organisation.
* How knowledge is formed in organizations.
* Ethical and social challenges related to information systems.
* Information systems in decision making process.
* Possibilities of information systems renewal and financial impact of it.
* The history of information systems discipline, its research methods and scientific journals.

Mode of delivery:
Online teaching
Covid-19 pandemian vuoksi opetus on kokonaan etäopetuksena syksyllä 2020./ Due to Covid-19 pandemic, teaching in Autumn 2020 will be implemented remotely. Details of arrangement can be found from the course web page, which will be available in Moodle. https://moodle.oulu.fi/course/view.php?id=4498

Learning activities and teaching methods:
Familiarizing lecture material, independent study of the course literature, weekly tasks and scientific essay. Total 133h.

Target group:
BSc students

Recommended or required reading:
Kenneth C. Laudon; Jane P. Laudon
Pearson International Content
2020

Assessment methods and criteria:
Active participation in lectures or online environment. Weekly tasks and scientific essay.

Grading:
Numerical scale 1-5 or fail

Person responsible:
Liisa Kuonanoja

Working life cooperation:
Possibly visiting lecturers from companies and other organizations

815345A: Software Architectures, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Pertti Seppänen
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 2nd spring semester of the Bachelor's studies.

Learning outcomes:
After passing the course, the student is able to:
* describe the concepts and techniques of the software architecture design – especially in case of object-oriented design,
* describe typical architecture solutions of main-stream modern software solutions – for instance apps of smart devices and server-based systems,
* identify and analyze the pros and cons of different software architectures from the viewpoints of software design & implementation, software execution, software quality and software maintainability,
* use UML modeling techniques to describe different perspectives of a software architecture,
* create different optional architectural solutions for a software based on its functional and non-functional requirements and evaluate the applicability of the optional architectures to the problem in question, as well as
* describe the role of architectural design in agile and iterative software development processes.

Contents:

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 24 h, exercises 20 h, exercise work as group work 90 h.

Target group:
BSc students.

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Data Modeling and Design

Recommended or required reading:

Assessment methods and criteria:
The course is passed by participating in the course assignments as well as by evaluation of the exercise work.

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Pertti Seppänen

Working life cooperation:
811325A: Databases, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Iisakka, Juha Veikko
Opintokohteen kielet: Finnish
Leikkaavuudet:

811395A Basics of Databases 5.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd year autumn semester of the Bachelor's studies.

Learning outcomes:
After completing the course, the student will be able to:
* apply the theory of the relational databases and the basics of the set theory,
* build a good quality relational database and use queries,
* use a relational database for storing persistent objects,
* use conceptual modelling for designing databases, as well as
* normalise a database and assess its quality.

Contents:
* Conceptual modelling
* Relational model and database
* SQL
* Quality of database
* Storing objects to the relational database

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 24 h, exercises 16 h, computer exercises 25 h, self-study 68 h

Target group:
BSc students

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Programming 2.

Recommended or required reading:
Coronel C & Morris S (2018), Database systems: design, implementation, and management, Australia: Cengage Learning

Assessment methods and criteria:
Continuous evaluation. The course will be divided to parts. Every part will be evaluated and all parts must pass.

Grading:
Numerical scale 1-5 or fail

Person responsible:
555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -  
Opiskelumuoto: Intermediate Studies  
Laji: Course  
Vastuuysikkö: Field of Industrial Engineering and Management  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Osmo Kauppila  
Opintokohteen kielet: Finnish

A440148: Module Preparing for the Major, Information Engineering, 40 op

Voimassaolo: 01.08.2015 -  
Opiskelumuoto: Module Preparing for the Option  
Laji: Study module  
Vastuuysikkö: Field of Industrial Engineering and Management  
Arvostelu: 1 - 5, pass, fail  
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Common Studies

521160P: Introduction to Artificial Intelligence, 5 op

Voimassaolo: 01.08.2017 -  
Opiskelumuoto: Basic Studies  
Laji: Course  
Vastuuysikkö: Computer Science and Engineering DP  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Riku Hietaniemi  
Opintokohteen kielet: English  
Leikkaavuudet:  
ay521160P Introduction to Artificial Intelligence (OPEN UNIV) 5.0 op

ECTS Credits:
5 ECTS credits /135 hours of work

Language of instruction:
Finnish, English
Lectures and main material in Finnish. English material for self study available.

Timing:
Period IV in spring semester. Recommended completion year: first or second.

Learning outcomes:
Upon completion the student the student will have the elementary skills to identify the potentially applicable artificial intelligence techniques for solving problems. He/she can recognize search, regression, classification, and clustering problems, and to explain the use of supervised and nonsupervised learning, performance measurements and metrics.

Contents:
- Introduction to artificial intelligence
- Search methods
• Supervised learning
• Regression
• Classification
• Data preprocessing
• Unsupervised learning
• Reinforcement learning
• Neural networks

Mode of delivery:
Face-to-face teaching. Online learning option available.

Learning activities and teaching methods:
Mode of delivery: Online teaching. Lectures 42h / exercise work 70 h / self-study 23 h. The exercises can be completed individually or as group work in multi-disciplinary teams.

Target group:
All Bachelor level students.

Prerequisites and co-requisites:
No prerequisites. Python programming skills are highly recommended.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
All course material (lectures and exercises) are available in course Moodle space.

Assessment methods and criteria:
The course utilizes continuous assessment. During the course there are five intermediate exams which will be used in final evaluation. The course also includes five exercises of which at least four need to be passed. These exercises can be completed individually or in groups.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Riku Hietaniemi

Working life cooperation:
Experts from industry are invited to present real world artificial intelligence solutions.

Other information:
Course learning environment is in Moodle moodle.oulu.fi.

521287A: Introduction to Computer Systems, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Teemu Leppänen
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay521287A  Introduction to Computer Systems (OPEN UNI)  5.0 op
  521142A  Embedded Systems Programming  5.0 op

ECTS Credits:
5

Language of instruction:
Lecturing in Finnish, course and exercise material available in English.

Timing:
Autumn, periods 1-2.

**Learning outcomes:**
Upon completing the course, the student understands the basics of computer architecture and CPU operation.
Student knows number systems and data representations in computer.
Student is familiar of I/O operation with peripheral devices.
Student is able to implement small programs with the C programming language for workstations and embedded systems.
Student recognizes how embedded systems programming is different from programming general-purpose computers.

**Contents:**
Overview of computer architecture and CPU, data types and memory management, interrupts, registers and I/O, general computer and embedded systems programming, basics of the C programming language.

**Mode of delivery:**
Web-based teaching + face-to-face teaching.

**Learning activities and teaching methods:**
Lectures (20h), course exercises (10-20h), laboratory exercise (3h) and course project in a group.

**Target group:**
Students of the University of Oulu

**Prerequisites and co-requisites:**
Elementary Programming 521141P

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Lecture notes and exercise material are available in the course website.
For English speaking students, either of the following material may be useful:

**Assessment methods and criteria:**
The assessment criteria is based on the learning outcomes of the course. Students complete the course exercises, participate to the laboratory exercise and complete the course project in a group. Assessment is based on the exercises and the course project. More detailed information on assessment is published in the lecture material.

**Grading:**
Numerical grading scale 1-5, zero stands for fail.

**Person responsible:**
Teemu Leppänen

**Working life cooperation:**
Visiting lectures with experts from local industry are possible.

**Other information:**
The course learning platform is Lovelace (lovelace.oulu.fi)
This course replaces the course 521142A Embedded systems programming.

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*Artificial Intelligence*

**805305A: Introduction to Regression and Analysis of Variance, 5 op**
Voimassaolo: 01.08.2017 - 
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Jari Päkkilä
Opintokohteen kielet: Finnish
Leikkaavuudet:
  806112P  Basic Methods of Data Analysis  10.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish

Timing:
Autumn term, 2nd period. Recommended to be taken already in the 2nd year for those aiming at specialization in data science.

Learning outcomes:
Upon successful completion of the course the student can describe the basic concepts and main principles of regression and variance analysis with one or several explanatory variables, and is able to apply these methods in analysing a small scale data set as well as to apply the necessary computational tools.

Contents:
Linear regression and analysis of variance models for continuous outcomes; Formulation of the model and interpretation of parameters; Fitting the models, estimation of parameters, and prediction with the method of least squares: Basic methods of model criticism and diagnostics; Use of R environment in modelling.

Mode of delivery:
Contact teaching

Learning activities and teaching methods:
Lectures 28 h, practicals 14 h, and independent work. The practicals include both homework and computer class exercises.

Target group:
Students of mathematical sciences and other interested. The course belongs to core studies for those with an orientation to data science. It is a prerequisite for those doing M.Sc. in computational mathematics and data science having data science as the specialization profile. The course is useful also for students of the Faculty of Science and the Oulu Business School as well as those of computer science or computational engineering, who have statistics as a minor subject.

Prerequisites and co-requisites:
806113P Introduction to Statistics or 806119P A Second Course in Statistics or corresponding abilities acquired otherwise.

Recommended optional programme components:
Is assumed as preliminary knowledge in the course 805306A Introduction to Multivariate Methods.

Recommended or required reading:

Assessment methods and criteria:
Practical exercises and final exam. Passing the course requires adequate participation in practical sessions and sufficient homework activity.

Grading:
Numeric assessment scale from 1 to 5

Person responsible:
Jari Päkkilä
Working life cooperation:
No

521495A: Artificial Intelligence, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Jaakko Suutala, Pekka Sangi
Opintokohteen kielet: English
Leikkaavuudet:
ay521495A    Artificial Intelligence (OPEN UNI)    5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
English

Timing:
The course in held in the spring semester, during period III. For bachelor students of Computer Science and Engineering specializing to artificial intelligence, it is recommended to complete the course at the 3rd spring semester.

Learning outcomes:
After completing the course, students
1. know the basic search strategies that can be applied in problem solving and optimization.
2. understand how search-based decisions are made in game-like competitive applications.
3. know the basic principles of probabilistic reasoning in artificial intelligence systems.
4. know how rational decision making under uncertainty can be formulated using utility theory.
5. understand the fundamentals of machine learning and how some of the established methods can be applied to problems in AI.
6. are familiar with advanced AI applications of perception and robotics and how probabilistic inference and machine learning can be used in these settings.

In the course projects, students get some experience in programming and using search methods.

Contents:
intelligent agent types, uninformed search methods, informed (heuristic) search, local search, constraint satisfaction problems, adversarial search, uncertainty handling, probabilistic reasoning, utility, machine learning, decision networks, Markov decision process, reinforcement learning, applications

Mode of delivery:
The tuition is implemented as web-based teaching. Moodle environment is used in the course. Due to Covid-19 pandemic, teaching in Spring 2021 will be implemented remotely. Course work space can be found from University of Oulu Moodle platform.
Moodle page in Spring 2021 will be https://moodle.oulu.fi/course/view.php?id=3211, where details of implementation will be provided. The page will be available from December 21, 2020. Online lectures will be given with Zoom and link for them will be provided in Moodle.

Learning activities and teaching methods:
Lectures 28 h / Group work (programming projects) 42 h / Self-study 65 h

Target group:
The primary target group is the students of the Computer Science and Engineering specializing in Artificial Intelligence.

Prerequisites and co-requisites:
Completion of the course "521160P Introduction to Artificial Intelligence" (lectured in Finnish) is recommended, but is not a prerequisite. It is also recommended that a student has completed studies related to probability and statistics (e.g. course "031021P Probability and Mathematical Statistics") and Python programming (e.g. course "521141P Elementary Programming").

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
The course utilizes materials of an introductory course on artificial intelligence taught at UC Berkeley (http://ai.berkeley.edu).

**Assessment methods and criteria:**
The assessment of the course is based on the final exam. Both the final exam and the course projects must be passed. Well-done course projects can increase the grade by one unit.

**Grading:**
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Pekka Sangi, Jaakko Suutala

**Working life cooperation:**
The course does not contain working life cooperation.

**Other information:**
Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi. Moodle page in Spring 2021 will be https://moodle.oulu.fi/course/view.php?id=3211

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811325A: Databases, 5 op

**Voimassaolo:** 01.08.2019 - 
**Opiskelumuoto:** Intermediate Studies 
**Laji:** Course 
**Vastuuysikkö:** Information Processing Science DP 
**Arvostelu:** 1 - 5, pass, fail 
**Opettajat:** Iisakka, Juha Veikko 
**Opintokohdien kielet:** Finnish 
**Leikkaavuudet:** 

811395A Basics of Databases 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd year autumn semester of the Bachelor's studies.

**Learning outcomes:**
After completing the course, the student will be able to:
* apply the theory of the relational databases and the basics of the set theory,
* build a good quality relational database and use queries,
* use a relational database for storing persistent objects,
* use conceptual modelling for designing databases, as well as
* normalise a database and assess its quality.

**Contents:**
* Conceptual modelling
* Relational model and database
* SQL
* Quality of database
* Storing objects to the relational database

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures 24 h, exercises 16 h, computer exercises 25 h, self-study 68 h

**Target group:**
BSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Programming 2.

**Recommended or required reading:**
Coronel C & Morris S (2018), Database systems: design, implementation, and management, Australia: Cengage Learning

**Assessment methods and criteria:**
Continuous evaluation. The course will be divided to parts. Every part will be evaluated and all parts must pass.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Juha Iisakka

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521157A: Introduction to Social Network Analysis, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Computer Science and Engineering DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mourad Oussalah

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 120 hours of works

**Language of instruction:**
English

**Timing:**
Period 4. It is recommended to complete the course at the end of period 4

**Learning outcomes:**
Upon completing the course, the student is expected to i) understand social aspects of the web; ii) learn to collect, clean and represent social media data; iii) quantify important properties of social media; iv) find and analyze (online) communities; v) understand the diffusion process in social network; vi) familiarize with simple modelling toolkits for social media analysis

**Contents:**
The course describes basics of social network analysis, allowing the students to understand structure and evolution of the network, while enabling them to use appropriate tools and techniques to draw inferences and discover hidden patterns from the network. The course is designed to accommodate computer science, mathematical and social science student background, which helps in emergence of multi-disciplinary research in the university

**Mode of delivery:**
Face- to-face teaching and laboratory sessions
**Learning activities and teaching methods:**
Lectures (24 h), tutorial/laboratory sessions (12h), seminar (6 h) and practical work. The course is passed with an approved practical work and class test. The implementation is fully in English.

**Target group:**
Students with moderate logical reasoning skills

**Prerequisites and co-requisites:**
None

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time

**Recommended or required reading:**

**Assessment methods and criteria:**
One class test (30%) in the middle of the term + Project work (70%)
Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
1-5

**Person responsible:**
Mourad Oussalah

**Working life cooperation:**
-

**Other information:**
We hope to attract students from humanities, economics and political in order to encourage multidisciplinary studies and enforce interesting student projects where each group contains at least one student from computer science and one from another faculty.

**811312A: Data Structures and Algorithms, 5 op**

Voimassaolo: 01.08.2010 -  
Opiskelumuoto: Intermediate Studies  
Laji: Course  
Vastuuysikkö: Information Processing Science DP  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Juustila, Antti Juhani  
Opintokohteen kielet: Finnish  
Leikkaavuudet:  
521144A Algorithms and Data Structures 6.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work.

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Bachelor's studies.

**Learning outcomes:**
After completing the course the student will be able to:
* select data structures and algorithms to an application,
* apply induction when proving algorithm correctness and define recursive algorithms,
* describe trees, graphs and their basic algorithms and apply them in a program,
* describe the most common sorting algorithms, as well as
* analyse the correctness and time complexity of an algorithm implemented in a program.
Contents:
* Basic data structures
* Analysis of algorithms
* Sorting algorithms
* Hash tables
* Binary search trees
* Graphs and their algorithms
* Algorithm design paradigms

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 48 h, exercises 21 h, exercise work 27 h, independent study 39 h.

Target group:
BSc students.

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses are accomplished:
Databases

Recommended optional programme components:

Recommended or required reading:
Cormen, Leiserson, Rivest, Stein: Introduction to algorithms, Second edition, MIT Press 2001 (or newer)
and other material defined during the course.

Assessment methods and criteria:
1. Exam and assignment OR 2. Mid-term exams (2) and assignment

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Antti Juustila

031025A: Introduction to Optimization, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Ruotsalainen Keijo
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 135 hours of work
Language of instruction:
English

Timing:
The course is held in the autumn, during period 1.

Learning outcomes:
After completing the course the student is able to solve optimization convex optimization problems with the
basic optimization algorithms. The student is also able to form the necessary and sufficient conditions for
the optimality.
Contents:
Linear optimization, Simplex-algorithm, nonlinear optimization, KKT-conditions, duality, conjugate gradient method, penalty and barrier function methods.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h / Group work 14 h / Self-study 93 h.
The course, Introduction to Optimization, will be lectured remotely through the ZOOM video conferencing tool. The more detailed instructions and access to ZOOM lectures can be found in the Moodle work space of the course. The link is here: https://moodle.oulu.fi/course/view.php?id=5350.

Target group:
Students in Wireless Communication Engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the courses Calculus I and II, Matrix algebra

Recommended optional programme components:

Recommended or required reading:
P. Ciarlet; Introduction to numerical linear algebra and optimization, M. Bazaraa, H. Sherali, C.M. Shetty; Nonlinear programming

Assessment methods and criteria:
The course can be completed by a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail

Person responsible:
Keijo Ruotsalainen

Working life cooperation:

Other information:
The course, Introduction to Optimization, will be lectured remotely through the ZOOM video conferencing tool. The more detailed instructions and access to ZOOM lectures can be found in the Moodle work space of the course. The link is here: https://moodle.oulu.fi/course/view.php?id=5350.

Computer Science

521145A: Human-Computer Interaction, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Simo Hosio
Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr
Language of instruction:
Finnish/English
Timing:
Autumn semester, Period II

Learning outcomes:
Upon completing this course, students will possess:
1. Knowledge of Human Computer Interaction (HCI) fundamentals
2. Knowledge and practical experience of user-centric computer interface and usability evaluation techniques, such as questionnaires and interviewing
3. Knowledge and experience of prototyping techniques (both paper-based as well as digital)
4. Knowledge of how HCI can be incorporated in the software development process

Contents:
Fundamental knowledge of humans, and how that relates to computer systems and interfaces. Learning design in 2-3 different ways, and conducting evaluations of the designs. Evaluation constitutes data collection and analysis, including qualitative and quantitative data.

Mode of delivery:
Online teaching (lectures), group work (labs).

Learning activities and teaching methods:
Lectures (12 h), exercises (16 h), and practical work (105 h). The course is passed with approved classroom/reading package reflections, and an approved group-based practical work (several assignments). The implementation is doable fully in English.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
While no specific courses are not required, elementary teamwork skills are required and the capability to provide documentation.

Recommended optional programme components:
All necessary material will be provided by the instructor.

Recommended or required reading:
No required reading.

Assessment methods and criteria:
The course completion relies on completed solo-work (reflections), and the numerical assessment is project-based. Students have to complete several individual exercises throughout the semester: ideating an application, designing various versions of its prototype, evaluating those prototypes, documenting the final application designs. Passing criteria: all stages of the project-based work must be completed, each receiving more than 50% of the available points.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Associate Professor Simo Hosio

Working life cooperation:
If relevant, guest lectures may be organized (optional).

Other information:
Using Moodle as the teaching platform: https://moodle.oulu.fi/course/view.php?id=5409

810122P: Computer Architecture, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Räsänen
Opintokohteen kielet: Finnish
Leikkaavuudet:
521267A Computer Engineering 4.0 op
Ei opintojaksokuvauksia.

521301A: Digital Techniques 1, 8 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Lahti
Opintokohteen kielet: Finnish
Leikkaavuudet:
521412A-02 Digital Techniques 1, Exercise Work 0.0 op
521412A Digital Techniques 1 6.0 op
521412A-01 Digital Techniques, Exam 0.0 op

ECTS Credits:
8

Language of instruction:
Finnish

Timing:
Periods 3-4

Learning outcomes:
1. After the course, students are able to ably binary number system and Boolean algebra in the form of switching algebra to the design and functional analyze of simple digital circuits.
2. In addition, they are also able to use in their designs graphical symbols specified in the dependency notation standard (SFS4612 ja IEEE/ANSI Std.91-1991) and different descriptions of function and structure of state machines.
3. Based on this knowledge, students are able to implement and analyze digital devices consisting of ordinary simple digital components.
4. After having assimilated the basic knowledge of digital technique, students are able to understand also the function and structure of micro controllers and micro processors.

Contents:
The principles of digital devices, Boolean algebra, numeral systems, operating principle, analysis and synthesis of combinational logic, flip-flops, operating principle, analysis and synthesis of sequential logic (state machines), physical characteristics of CMOS technology, registers and register transfers, computer memory, instruction set architecture, computer design basics, interfaces and data transmission.

Mode of delivery:
Classroom

Learning activities and teaching methods:
Lessons 40 h, weekly home assignments.

Target group:
Primarily 1st year electrical engineering and computer science and engineering BSc students. The course can be taken by the students of the university of Oulu.

Prerequisites and co-requisites:

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Text books, MIT OpenCourseWare and exercise literature.

**Assessment methods and criteria:**

Project work and home assignments
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Project work and home assignments are assessed on numerical scale 1-5. The average of project work and home assignments will be the final grade.

**Person responsible:**

Antti Mäntyniemi

**Working life cooperation:**

-

**Other information:**

-

521150A: Introduction to Internet, 5 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Electrical Engineering DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Erkki Harjula

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS credits / 133 hours of work

**Language of instruction:**

All materials are in English, lectures are given in Finnish.

**Timing:**

Spring, period 4.

**Learning outcomes:**

Upon completion of this course, students know and understand the basic concepts, know the key terminology and can write clearly with justifications about the following key areas of the course, which are:

1. The design principles of the Internet, its architecture, functionality and challenges
2. The role of the data link layer and the most important access network technologies
3. The structure and the most important protocols of the TCP/IP protocol stack
4. The most important Internet applications and their protocols
5. The basic principles of internet security and multimedia applications

Additionally, students who have attained grades 2 or 3 have demonstrated satisfactory capability to perform practical software implementation work and/or solving Internet-related problems relevant to most centric course key areas. Students who have attained grades 4 or 5 have demonstrated solid capability to perform practical software implementation work and analytical skills for solving technical and research problems relevant to the course key areas.

**Contents:**

The design principles and architecture of the Internet, data link layer and most important access network technologies, TCP/IP protocol stack and its most important protocols, most important Internet applications, principles of Internet security and multimedia, internet's challenges and Future Internet.

**Mode of delivery:**

Remote teaching.

**Learning activities and teaching methods:**

Remote teaching: Lectures 32h, exercises 16h, laboratory exercises 12h, course work 25h, independent work 48h. Work is done in groups or independently.
Details of arrangement can be found from the course web page in Moodle: https://moodle.oulu.fi/course/view.php?id=4029

**Target group:**
Communications Engineering, Computer Science and Engineering students, Information Processing Science students, other students of the University of Oulu.

**Prerequisites and co-requisites:**
None.

**Recommended optional programme components:**
None.

**Recommended or required reading:**
Announced at the beginning of the course.

**Assessment methods and criteria:**
Passing the course requires mastery of the essential core content of the course. Continuous assessment and exams are provided for students to show that they have attained this level. Higher grades are attained by participating in and completing, either alone or in groups, to non-mandatory exercises and exams on advanced course topics. More detailed information on assessment is published yearly in the lecture material.

Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D.Sc. Erkki Harjula

**Working life cooperation:**
None.

**521159P: Principles of Digital Fabrication, 5 op**

- **Voimassaolo:** 01.01.2017 -
- **Opiskelumuoto:** Basic Studies
- **Laji:** Course
- **Vastuuysikkö:** Computer Science and Engineering DP
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Georgi Georgiev
- **Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
ay521159P Principles of Digital Fabrication (OPEN UNI) 5.0 op

**ECTS Credits:**
5 ECTS credits/ 135 hours of work

**Language of instruction:**
Finnish/English

**Timing:**
The course will be held in the spring semester, during period IV.

**Learning outcomes:**
In this course the students will learn the whole process of digital fabrication in FabLab. They will learn how to create an interactive 3D prototype, design mechanical parts for prototype, create basic electronics, implement a control logic for open hardware embedded board, and work in teams on project.

**Contents:**
The course teaches students to (1) design mechanical components with solid modeling tools, (2) build necessary electronics, and (3) implement software to a microcontroller, to create in FabLab a physical gadget that interacts with the world around it.

**Mode of delivery:**
Online (Lectures and TA sessions)/ Individual work towards project.

**Learning activities and teaching methods:**
Lectures 30h / Individual work 123h. There are sessions each week online where guidance is available (min total 16 h).

**Target group:**
This course is included in the computer science bachelor degree program. It is also available for all degree programs in the university. The course is offered to high-school students.

**Prerequisites and co-requisites:**
- 

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
There is no recommended or required reading. The tutorials for tools and software (or links to such tutorials) will be provided in the course.

**Assessment methods and criteria:**
The course will be evaluated on the basis of the project delivered by the teams of students. Essential part of this reporting is the documentation of the project.

**Grading:**
pass/fail

**Person responsible:**
Georgi Georgiev

**Working life cooperation:**
- 

**Other information:**
The course is also offered to high-school students with special study right and gives 5 ECTS credits that can be included in some bachelor's degrees at University of Oulu.
Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi

521337A: Digital Filters, 5 op

**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Computer Science and Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Olli Silven
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
ay521337A  Digital Filters (OPEN UNI)  5.0 op

**ECTS Credits:**
5 ECTS cr

**Language of instruction:**
Finnish, English study material available

**Timing:**
Spring, period 3.

**Learning outcomes:**
1. Student is able to specify and design respective frequency selective FIR and IIR filters using the most common methods.

2. Student is able to solve for the impulse and frequency responses of FIR and IIR filters given as difference equations, transfer functions, or realization diagrams, and can present analyses of the aliasing and imaging effects based on the responses of the filter.

3. Student is able to explain the impacts of finite word length in filter design.

4. Student has the necessary basic skills to use signal processing tools available in Matlab environment and to judge the results.

Contents:

Mode of delivery:
Online teaching (Lectures), independent work, group work

Learning activities and teaching methods:
Online lectures and exercises 50 h. The design exercises familiarize the students with the methods of digital signal processing using the Matlab software package. The rest as independent work.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
031077P Complex Analysis, 031080A Signal Analysis

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course can be passed either with week exams or a final exam. In addition, the exercises need to be returned and accepted.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Olli Silven

Working life cooperation:
None.

Other information:
Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi.
Open University students enroll for studies through an open website.
**A440145: Module Preparing for the Major, Mining Technology and Mineral Processing, 40 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Module Preparing for the Option

**Laji:** Study module

**Vastuuysikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

**Electives**

**491101P: Introduction to mining, 5 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuysikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Saija Luukkanen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 cr

**Language of instruction:**

Finnish. Materials possibly partly in English.

**Timing:**

Autumn term, period 1

**Learning outcomes:**

After completing the course student can explain the various stages of mine value chain from exploration until the final concentrate. A student understands economical, social and environmental aspects of sustainable mining.

**Contents:**

Different stages of mine development: exploration, environmental aspects, geochemical and geophysical measurements, basics in mining engineering and mineral processing.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Lectures, practicals, final exam

**Target group:**

Bachelor's students in mining engineering and mineral processing, geosciences and process engineering

**Recommended or required reading:**

Online materials presented during the lectures

**Assessment methods and criteria:**

Final exam, practicals, activity

**Grading:**

5-1/failed
Person responsible:
Prof. Saija Luukkanen

477121A: Particle Technology, 5 op

Voimassaolo: 01.08.2015 - 31.07.2022
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohteen kielet: Finnish
Leikkaavuudet:
  477120A  Fluid and Particle Engineering  5.0 op
  477101A  Fluid and Particle Engineering I  3.0 op

ECTS Credits:
5 ECTS / 133 h of work
Language of instruction:
Finnish
Timing:
Implementation in spring term, period 4.

Learning outcomes:
Upon completion of the course, a student should be able to identify the mainline mechanical processes in process industry enhancing the degree of upgrading, as well as recovery operations related to those mechanical main processes. The student is able to identify the equipment related to the mechanical processes and can explain their purpose of use and their operational principles.

Contents:
Granular material and sampling, particle size and particle size distribution, specific surface area, basics in grinding, crushing, sieving and mineral concentration, froth flotation, mineral concentration methods.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
The implementation methods of the course are varying. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works or with web learning.

Target group:
Bachelor students in process and environmental engineering

Prerequisites and co-requisites:
477013P Introduction to process and environmental engineering

Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:
This course utilizes continuous assessment including two intermediate exams with group and/or homework. Alternatively, the course can also be completed by taking the end exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
No
477122A: Bulk Solids Handling, 5 op

Voimassaolo: 01.08.2015 - 31.07.2023
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohteen kielet: Finnish
Leikkaavuudet:
477102A Bulk Solids Handling 4.0 op
477120A Fluid and Particle Engineering 5.0 op

ECTS Credits:
5 ECTS / 133 h of work

Language of instruction:
Finnish

Timing:
Implementation in period 2 (autumn term).

Learning outcomes:
Upon completion of the course, a student should be able to identify auxiliary mechanical unit processes as well as equipment and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
The implementation methods of the course vary. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works or with web learning.

Target group:
Bachelor students in process or environmental engineering

Prerequisites and co-requisites:
477101A Particle Technology

Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures

Assessment methods and criteria:
This course utilizes continuous assessment.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
No

477401A: Thermodynamic Equilibria, 5 op
ECTS Credits:
5 cr / 135 hours of work.

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd autumn semester.

Learning outcomes:
Student is capable of defining chemical equilibria of the systems that are related to industrial processes and understands the relevance of equilibria (and their computational determination) as a part of process analysis, planning and control. Additionally, (s)he can define a meaningful system to be considered in computation thermodynamics; i.e. (s)he can create a computationally solvable problem based on technical problem that in itself is not solvable computationally.

Contents:
Concepts of entalphy (H), entropy (S) and Gibbs free energy (G). The effect of temperature and pressure on H, S and G. Chemical and phase equilibria. Activity and activity coefficient. Calculation of thermodynamic equilibria using equilibrium constant as well as Gibbs free energy minimisation.

Mode of delivery:
Classroom education

Learning activities and teaching methods:
Lectures (26 hours), software exercises (4 hours) as well as other exercises. Only in Finnish.

Target group:
Students of process and environmental engineering

Prerequisites and co-requisites:
'Basic Principles in Chemistry' and 'Material and Energy Balances' or corresponding knowledge is recommended as prerequisite.

Recommended optional programme components:
This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a education that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:
Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:
Students are required to make a portfolio consisting of a learning diary and exercises. Please note that the course is organised only in Finnish.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Eetu-Pekka Heikkinen

Working life cooperation:
There is no direct working life cooperation in this course.

**Other information:**
It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

### 477221A: Material and Energy Balances, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Field of Process and Environmental Engineering

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Mikola

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- ay477231A Material and Energy Balances I (OPEN UNI) 2.0 op
- ay477232A Material and Energy Balances II (OPEN UNI) 3.0 op
- ay477221A Material and Energy Balances (OPEN UNI) 5.0 op
- 477201A Material and Energy Balances 5.0 op
- 470220A Fundamentals of Chemical Process Engineering 5.0 op

**ECTS Credits:**
5 ECTS /133 hours of work

**Language of instruction:**
Finnish. The course can be completed in English as a book examination.

**Timing:**
Spring periods 3 and 4.

**Learning outcomes:**
The student is able to formulate material and energy balances for a process by taking into account the restrictions set by reaction stoichiometry. The student knows how the created mathematical formulation can be exploited in process consideration.

**Contents:**
Formulation of material and energy balances by taking into account the effects of chemical reactions. Multiunit cases are also considered.

**Mode of delivery:**
Lectures and group exercise

**Learning activities and teaching methods:**
Lectures 40h, group work 10h and self-study 80h

**Target group:**
Bachelor students in of Process or Environmental Engineering, minor subject students in relevant disciplines.

**Prerequisites and co-requisites:**
High school level chemistry, mathematics and physics.

**Recommended optional programme components:**
The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

**Recommended or required reading:**

**Assessment methods and criteria:**
During the course, there are two intermediate exams and both of them must be passed. Alternatively, a student can participate in the final exam after the course. In addition to this, the students will be making a group exercise, which will be evaluated.

**Person responsible:**
Juha Ahola

**Other information:**
This course replaces the course 477201A Material and Energy Balances, 5 ects.

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**771113P: Introduction to Geology I, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuysikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kari Strand

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
ay771113P Introduction to Geology I (OPEN UNI) 5.0 op

**ECTS Credits:**
5 credits

**Language of instruction:**
Finnish

**Timing:**
1st year autumn

**Learning outcomes:**
Students have an understanding of the basic concepts of the Earth, from its composition and internal structure to the geological processes that have led to its evolution to the present Earth as part of the solar system. They can tell how endogenic processes in the mantle and crust produce magmas and how magmas produce different igneous rock types upon emplacement below and on the Earth’s surface. Students are able to recognize and classify common igneous rocks based on their mineral composition and are familiar with common metamorphic rocks and know the metamorphic facies concepts. They can relate deformation and metamorphism of the rocks to plate tectonic processes.

**Contents:**
Evolution of the Earth as part of the solar system, structure and composition of the Earth. Classification of igneous rocks, magmatism, origin and crystallization of magmas, volcanism, metamorphism and formation of metamorphic rocks, plate tectonics and deformation structures.

**Mode of delivery:**
Face to face

**Learning activities and teaching methods:**
36 h lectures, 6 h exercises

**Target group:**
1st year geoscience students. The course is a good minor subject course for others.

**Prerequisites and co-requisites:**
Basic course in mineralogy (771102P) is parallel to this course.

**Recommended optional programme components:**
This course is intended as an introduction to the scope and methods of igneous and metamorphic petrology.

**Recommended or required reading:**
Assessment methods and criteria:  
Written examination and identification test of rock types.  
Grading:  
5-1/fail  
Person responsible:  
Kari Strand  
Working life cooperation:  
No  

771117P: Basic course in mineralogy, 5 op  
Voimassaolo: 01.08.2017 -  
Opiskelumuoto: Basic Studies  
Laji: Course  
Vastuuysikkö: Oulu Mining School  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Pekka Tuisku  
Opintokohteen kielet: Finnish  
ECTS Credits:  
5 ects  
Person responsible:  
Pekka Tuisku  

774311A: A Basic Course in Geochemistry, 5 op  
Voimassaolo: 01.08.2017 -  
Opiskelumuoto: Intermediate Studies  
Laji: Course  
Vastuuysikkö: Oulu Mining School  
Arvostelu: 1 - 5, pass, fail  
Opintokohteen kielet: Finnish  
ECTS Credits:  
5 cr  
Language of instruction:  
The language of instruction is Finnish. The course can also be completed in English as a book examination.  
Timing:  
The course is held in the spring semester, during period 3  
Learning outcomes:  
Opintojakson suorittavana opiskelijana:  
- osaa määritellä geokemiaan eri osa-alueet,  
- osaa yleiskuvan siitä, kuinka alkuaineiden käyttäytymistä luonnossa sätelevät fysiko-kemialliset prosessit ja alkuaineiden elektronirakenteet erot ovat aikojen kulussa saaneet aikaan maapallon erilaistumisen eri kehiin ja vaikuttavat alkuaineiden käyttäytymiseen geologisissa prosessissa,  
- osaa muuttaa geokemiaillista analyysiaineistoa muodosta toiseen (esim. painoprosenteista molekkylisosuuksiksi), osaa sijoittaa analyysiaineistoa erilaisille diagrammeille, ja  
- kykenee suorittamaan yksinkertaisia laskuja koskien massatasapainoa ja mineraalien saostumis- ja liukennemisreaktiota.
Contents:
Geochemistry as a field of science; history of geochemistry; tasks and fields of geochemistry; origin and electron configuration of chemical elements; origins and structure of the Earth; meteorites; the geochemical classification of the elements; composition of earth's different spheres; geochemical differentiation; composition of magmas; dissolution and precipitation of minerals; pH-Eh-diagrams; introduction to isotope geochemistry.

Mode of delivery:
Face to face teaching

Learning activities and teaching methods:
32 h lectures, 12 h exercises

Target group:
All students in geosciences, and mining engineering and mineral processing

Prerequisites and co-requisites:
A basic course in chemistry

Recommended optional programme components:
The course in an independent entity and does not require additional studies carried out at the same time

Recommended or required reading:

Assessment methods and criteria:
Examination in both theory and calculations

Grading:
The course utilizes a numerical grading scale 1-5. The grade is calculated as the average of the marks of two exams. Zero stands for a fail.

Person responsible:
Pertti Sarala

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

A440141: Module Preparing for the Major, Mechanical Engineering, 40 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Common Studies

464101A: Machine drawing and CAD, 5 op
Voimassaolo: 01.08.2015 -  
Opiskelumuoto: Intermediate Studies  
Laji: Course  
Vastuuysikkö: Field of Mechanical Engineering  
Arvostelu: 1 - 5, pass, fail  
Opintokohteen kielet: Finnish  
Leikkaavuudet:

464051A  Machine Drawing  3.5 op  
464051A-01  Machine Drawing, examination  0.0 op  
464051A-02  Machine Drawing, exercise  0.0 op  
464052A  CAD  3.5 op  

ECTS Credits:  
5 ects / 133 hours of studying work.  

Language of instruction:  
Finnish, can be completed in English as a book examination  

Timing:  
Lectures, Autumn periods 1.-2. Exercises, periods 1. - 2. , and practical work, period 2.  

Learning outcomes:  
The aim of the course is to teach students to read and to draw machine drawings and to carry out standard specifications of description methods, legends and dimensioning. Students also learn how to use the computer system for modeling and drafting machine parts and assemblies.  

Contents:  
Purpose of machine drawing; Description and dimensioning of parts; Design and viewpoints of manufacturing; Specifications of welds and surface roughness and tolerances on drawings; Principles of diagrammatic drawings. Machine parts and assembly modeling and making drawings with computer aided design software.  

Mode of delivery:  
Face-to-face  

Learning activities and teaching methods:  
Lectures 30 h / exercises 30 h / computer aided design exercises 20 h / practical work 53 h. Drawing and Modeling exercises will be group exercises and practical work will be individual.  

Target group:  
1st year mechanical engineering students  

Recommended optional programme components:  
The course is an independent entity and does not require other studies to be completed at the same time.  

Recommended or required reading:  
Pere, A.: Koneenpiirustus1 & 2, Kirpe Oy, Espoo. Other literature will be informed on lectures.  

Assessment methods and criteria:  
Final exam 50%, exercises 25% and practical work 25% of the final grade.  

Grading:  
Numerical grading scale 1-5 / fail  

Person responsible:  
Jussi Salakka  

465101A: Introduction to materials for mechanical engineering, 5 op  
Voimassaolo: 01.08.2015 -  
Opiskelumuoto: Intermediate Studies  
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Anna Kisko
Opintokohteen kielet: Finnish

Leikkaavuudet:

- 465061A-01 Materials Engineering I, examination 0.0 op
- 465061A-02 Materials Engineering I, design exercise 0.0 op
- 465061A-03 Materials Engineering I, laboratory exercise 1 0.0 op
- 465061A-04 Materials Engineering I, laboratory exercise 2 0.0 op
- 465061A-05 Materials engineering I, laboratory exercise 3 0.0 op
- 465061A Materials Engineering I 5.0 op

ECTS Credits:
5 ects/135 hours study time

Language of instruction:
Finnish

Timing:
Lectures and laboratory works, 3 and 4 periods

Learning outcomes:
The aim of the course is to introduce the common physical (metallurgical) phenomena in metal alloys and other construction materials. He/she understands the effect of different microstructural features on the mechanical properties and the processibility of the above mentioned materials. Finally, he/she is familiar with typical non-destructive and destructive testing techniques in material science.

Contents:
Solidification and phase transformations, plastic deformation, static recovery and recrystallization, effect of microstructure on mechanical properties of metal alloys, typical corrosion mechanisms, fatigue in metal alloys, creep in metal alloys, and non-destructive and destructive material testing.

Mode of delivery:
Face-to face teaching

Learning activities and teaching methods:
32 hours lectures/ 12 hours laboratory exercises/91 hours indepedent studies. Three laboratory excersises are included in the course.

Target group:
Mandatory in the bachelor's stage for all students in the Mechanical Engineering Degree Program.

Prerequisites and co-requisites:
None

Recommended or required reading:
Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Assessment methods and criteria:
Final exam. The final grade is based on the final exam.

Grading:
Numerical grading scale 1 - 5. Laboratory exercises will be graded as "pass"/"fail".

Person responsible:
Anna Kisko

463101A: Introduction to manufacturing technology, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
**Vastuuyksikkö:** Field of Mechanical Engineering  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Jouko Heikkala  
**Opintojen kielet:** Finnish  

**Leikkaavuudet:**  
463052A-01  Introduction to Manufacturing Technology, examination  0.0 op  
463052A-02  Introduction to Manufacturing Technology, exercises  0.0 op  
463052A  Introduction to Manufacturing Technology  5.0 op

**ECTS Credits:**
5 ECTS

**Language of instruction:**
Finnish

**Timing:**
Lectures and exercises periods 3. - 4.

**Learning outcomes:**
The aim of this course is to give students a general view of manufacturing methods. The primary emphasis of the course is on the cutting methods of metals. Upon completion of the course, the student is able to name the key areas of manufacturing technology and the most important cutting methods. In addition, the student is able to choose the applicable cutting methods and tools for achieving the basic manufacturing tolerances. The student is able to explain the basic features of the most common materials of cutting tools.

**Contents:**
Mechanical engineering materials, workshop manufacturing methods and tools, measurements, assembly, manufacturing design, numerical control.

**Mode of delivery:**
Face-to-face teaching, independent work.

**Learning activities and teaching methods:**
The course includes 20 hours of lectures, lecture assignments, lesson assignments, practical work / seminar, laboratory work and exam.

**Recommended or required reading:**
Ihalainen, E., Aaltonen, K., Aromäki, M., Sihvonen, P.: Valmistustekniikka, Otatieto Oy, Helsinki 2007, 490 s. Supplementary material will be given during the lectures.

**Assessment methods and criteria:**
Exam and examinations are graded. The overall grade is determined as follows:
- Required exam grade 30 %
- Compulsory Assignment 25 %
- Lecture Assignment 15 %
- Volunteer Demo in the Machine Workshop 10 %
- Part performances of the course will expire during the Academic year

**Grading:**
Numerical grading scale 1-5.

**Person responsible:**
Jouko Heikkala

462103A: Introduction to Maintenance, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouni Laurila
Opintokohteen kielet: Finnish
Leikkaavuudet:

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<td>Maintenance Technology, exercise work</td>
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<td>464087A</td>
<td>Maintenance Technology</td>
<td>5.0 op</td>
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ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

Learning outcomes:
After completing the course, students will be able to explain key concepts related to the maintenance industry, define what maintenance is, and describe its most important impacts on productivity, safety and the environment. The student will be able to name the levels of maintenance activities and describe what aspects are involved in choosing a maintenance strategy. After the course the student is able to calculate the most important reliability indicators and evaluate the overall efficiency of production equipment and the factors affecting it. and classify maintenance activities as corrective and preventive. The student is able to explain what issues and practices are essential for keeping the production assets in good condition. The student can also take into account maintenance related issues in different planning tasks.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
More detailed performance methods are given at the start of the course.

Target group:
Bachelor's degree students in the mechanical engineering

Recommended optional programme components:
The course is an independent entity.

Recommended or required reading:
Lecture handout and the other material delivered during the course. Supplementary readings: Järviö, J., Kunnossapito. Helsinki, KP-Media Oy / 2012.

Assessment methods and criteria:
Final examination and the other graded assignments

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jouni Laurila.
Learning outcomes:
Upon completion of the course, the student will be able to explain how the information technology is utilized in modern machines. The student is able to describe how the modern machines are developed from purely mechanical systems to multi-disciplinary systems. The student is able to sort out the electrical, information technological and mechanical features of modern machines. He/she is also able to describe the interaction and interfaces of the aforementioned features. In addition to this, the student is able to separate the digital and analog domains. The student is able to create a simple computer program for machine control. He/she is able to name the sensors and actuators being used in automated machines. Furthermore, the student is able to list examples of machines taking advantage of modern information technology.

Contents:
History of mechanical engineering and information technology; Information technology as an enabler of the development of machines; Requirements and boundary conditions for automatisation of machines; Concepts of information technology and electronics; Basics of programming and logical reasoning; Examples of machine applications taking advantage of modern information technology.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 20 h / Group work 12 h / Self-study 101 h

Target group:
Bachelor's degree students of mechanical engineering

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture notes. Other material is in the beginning of the course.

Assessment methods and criteria:
This course utilizes continuous assessment. During the course there are exercises and intermediate exams. The exercises and the exams will be assessed. The assessment of the course is based on the learning outcomes of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Lecturer Toni Liedes
Arvostelu: 1 - 5, pass, fail
Opettajat: Louhisalmi, Yrjö Aulis
Opintokohteen kielet: Finnish

Leikkaavuudet:

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<td>Machine Automation I, examination</td>
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<td>464064A</td>
<td>Actuators</td>
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ECTS Credits:
5 cr / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 3 and 4. It is recommended to complete the course at the 2nd spring semester.

Learning outcomes:
After completing the course the student can explain the role of actuators in machine automation systems. The student recognizes different types of actuators and can categorize them eg. based on performance and usage limitations. The student is able to design a simple actuator operation and is able to select suitable actuators for a typical automation application. In addition, the student is able to evaluate the sensing needs and operating conditions of actuators as part of the automation system.

Contents:
Basics actuators; Basics of hydraulics, Pneumatics and electrical drives; Performance and efficiency of actuators; Hydraulic actuators; Pneumatic actuators; Electrical actuators.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 32 h / Group work 16 h / Self-study 85 h

Target group:
Bachelor's degree students of mechanical engineering

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture materials. Other material is in the beginning of the course.

Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, homework, exercises, seminars and exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Yrjö Louhisalmi

Machine Design

461102A: Statics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lahtinen, Hannu Tapio
Opintokohteen kielet: Finnish
Leikkaavuudet:
- ay461102A Statics (OPEN UNI) 5.0 op
- 461016A-01 Statics, examination 0.0 op
- 461016A-02 Statics, exercises 0.0 op
- 461016A Statics 5.0 op

ECTS Credits:
5 ETCS / 149 hours of work

Language of instruction:
Lectures in finnish, foreign students follow the course by reading independently the books in english and taking part to the exercises and exams where all material is given in english.

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:
After the course, the student can calculate forces and moments of loaded structures using equations of vector algebra and trigonometry. He/she can draw a free body diagram of the force system and then solve the unknown forces by using equations of equilibrium. He/she can determine resultants from uniformly distributed loads and apply Coulomb's law of friction in the problem equilibrium. The student can solve problems of internal and external forces of particle systems and rigid body systems in case of static equilibrium. Especially, he/she can draw shear force and bending moment diagrams for beam structures.

Contents:
Fundamental laws and concepts in statics. Force systems and their treatment. Equilibrium of particles and rigid bodies. Static forces in isostatic structures such as beams, frames, cables and trusses. Friction.

Mode of delivery:
Implemented as Face-to-face -teaching.

Learning activities and teaching methods:
Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

Target group:
Compulsory for candidate degree students of mechanical engineering programme.

Prerequisites and co-requisites:
Now prerequisites required.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Hannu Lahtinen

Other information:
The course gives ability for understanding static equilibrium, ability for determining force balance in structures and readiness for later studies.

461103A: Strength of materials I, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lahtinen, Hannu Tapio
Opintokohteen kielet: Finnish

Leikkaavuudet:
- 461010A-01 Strength of Materials I, examination 0.0 op
- 461010A-02 Strength of Materials I, exercises 0.0 op
- 461010A Strength of Materials I 7.0 op

ECTS Credits:
5 ETCS / 149 hours of work

Language of instruction:
Lectures in Finnish, foreign students follow the course by reading independently the books in English and taking part to the exercises and exams where all material is given in English.

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:
After the course, the student can determine stresses and strains of structures under loading. He/she can change the general stress and strain states from one coordinate system to another and can also apply constitutive equations in calculations. The student can dimension typical structures such as tension and compression bars, torsion bars and straight beams.

Contents:

Mode of delivery:
Implemented as Face-to-face teaching.

Learning activities and teaching methods:
Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

Target group:
Compulsory for Bachelor's degree students of mechanical engineering programme.

Prerequisites and co-requisites:
The recommended preceding course is 461102A Statics.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Hannu Lahtinen

Other information:
The course looks into the most important principal concepts of strenght of materials and gives ability for dimensioning of simple structures such as straight bars in tension, compression or torsion loads and straight beams under bending moments.

464102A: Design of machine elements, 10 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eino Antikainen
Opintokohteen kielet: Finnish
Leikkaavuudet:
  464055A  Machine Design I  8.0 op
  464055A-01 Machine Design I, examination  0.0 op
  464055A-02 Design exercise  0.0 op
  464055A-03 Design exercise I, home exercises  0.0 op
  462033A  Machine Design  7.0 op

ECTS Credits:
10 ects / 267 hours of studying work.

Language of instruction:
Finnish, can be completed in English as a book examination

Timing:
Lectures and exercises arranged at autumn periods 1 -2., practical work end of 2 period.

Learning outcomes:
Upon completion of this course, the student will know operating principals, material selection and dimensioning of machine elements. Learning outcomes: Upon completion of this course, the student is able to measure dimensions of the machine elements.

Contents:
Joint elements (screws, welds, etc.); Rotating machine elements (shafts, bearings, clutches, brakes);
Power transmission elements (gears, chains, belts, etc.); Basics of needed vibration isolation to ensure smooth operation of machines

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 60 h / exercises 14 h /practical work 120 h / individual studies 73 h.

Target group:
2nd year mechanical engineering student

Prerequisites and co-requisites:
Machine Drawing and CAD
Recommended or required reading:

Assessment methods and criteria:
Final Exam, homeworks and practical work. Final exam is 50% and practical work 50% of final grade. Homeworks will be graded pass/fail.

Grading:
Numerical grading scale 1-5 / fail

Person responsible:
Eino Antikainen

464103A: Machine design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Niskanen, Juhani
Opintokohteen kielet: Finnish
Leikkaavuudet:
   464056A Machine Design II 6.0 op
   464056A-01 Machine Design II, examination 0.0 op
   464056A-02 Design II, exercise 0.0 op
   464062S Engineering Design 20.0 op

ECTS Credits:
5 ects / 133 hours of studying work.

Language of instruction:
Finnish, can be completed in English as a book examination

Timing:
Lectures spring period 3 and 4.

Learning outcomes:
Upon completion of this course, the student is able, as a member of a design group, to design an entire machine, explain material selections and answer for meaning to be responsible of dimensioning of machine elements. Student is also able to design new product or essentially improve old product. Student knows what is required when working as a part of a product development project.

Contents:
Advanced machine design, design of assemblies and design methods. Utilization of Automation and new materials. Meaning of a machine directive.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 40 h / practical work 93 h.

Target group:
3rd year mechanical engineering students

Prerequisites and co-requisites:
Design of machine elements, Engineering drawing and CAD.

Recommended optional programme components:
The course of study is an independent entity and does not require other studies to be completed simultaneously.
**Recommended or required reading:**

**Assessment methods and criteria:**
Final Exam and practical work. Final exam is 50% and practical work 50% of final grade

**Grading:**
Numerical grading scale 1-5 / fail

**Person responsible:**
Professor Juhani Niskanen

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**Mechatronics**

**462104A: Machine automation, 5 op**

Voimassaolo: 01.08.2015 -  
Opiskelumuoto: Intermediate Studies  
Laji: Course  
Vastuuysikkö: Field of Mechanical Engineering  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Louhisalmi, Yrjö Aulis  
Opintokohteen kielet: Finnish

Leikkaavuudet:  
462022S-01 Machine Automation II, examination 0.0 op  
462022S-02 Machine Automation II, exercise work 0.0 op  
462022S Machine Automation II 5.0 op

**ECTS Credits:**
5 cr / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

**Learning outcomes:**
Upon completion of the course, the student will be able to explain the basic principles and structures of a typical machine automation system. The student is able to divide an automation system into basic elements and explain their role and significance in the system. The student can apply the basic digital technology and logic methods in designing a typical machine automation system. In addition to this, the student knows the operating principles of programmable logic controllers (PLCs) and is able to implement a logic control for a typical application. Furthermore, the student is able to explain the basic principles of fieldbuses. The students also knows the basics of machine automation safety design.

**Contents:**
Basics of automation; Basics of digital technology and logic; Description of operation sequences; Architecture of programmable logic controllers and their programming; Distributed systems and fieldbuses.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures 32 h / Group work 16 h / Self-study 85 h

**Target group:**
Bachelor's degree students of mechanical engineering
Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course:
Actuators in Machine Automation, Elementary Programming

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. However, it is recommended to complete the course Machine Sensor Technology simultaneously.

Recommended or required reading:
Lecture material. Other material is in the beginning of the course.

Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, homework, exercises, seminars and exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Yrjö Louhisalmi

462105A: Machine Sensor Technology, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Toni Mikael
Opintokohteen kielet: Finnish
Leikkaavuudet:
  462053A  Sensor Technology of Machine Automation  5.0 op

ECTS Credits:
5 cr / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

Learning outcomes:
Upon completion of the course, the student will be able identify, classify and bring into use the most common sensor types used in machine automation. The student is able to choose sensors for typical automation applications. In addition to this, the student is able to design a common analog and digital signal transmission and conditioning chain.

Contents:
Basics measuring systems; Classification of sensors; Characteristics of analog and digital domain; Analog to digital conversion; Basics of analog signal conditioning: amplification, attenuation and filtering; Operating principle of digital sensors; Examples of typical sensors used in mechanical engineering and civil engineering;

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 32 h / Group work 16 h / Self-study 85 h

Target group:
Bachelor's degree students of mechanical engineering
Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: Actuators in Machine Automation

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, exercises, seminars and exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Lecturer Toni Liedes

462106A: Precision engineering, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Louhisalmi, Yrjö Aulis
Opintokohteen kielet: English

Leikkaavuudet:
462038A-01 Precision Engineering, examination 0.0 op
462038A-02 Precision Engineering, exercise work 0.0 op
462038A Precision Engineering 3.5 op

ECTS Credits:
5 cr / 133 hours of work

Language of instruction:
English

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 3rd or 4th spring semester.

Learning outcomes:
Upon completion of the course, the student can analyze structures and components used in precise engineering products, can explain working principles of them and can design new qualified and easily manufactured precise engineering products.

Contents:
Introduction, design of precision mechanical devices, enclosure and usability of devices, fixed and removable joints, implementation of rotary and linear motion, and the most common precision and micromechanical manufacturing methods.

Mode of delivery:
Blended teaching. The course is lectured in English, possible exercises are taught face to face. Final exam in English.

Learning activities and teaching methods:
Lectures 28 h / group working 15 h / independent studying 90 h

Target group:
Bachelor's Degree students in Mechatronics and machine diagnostics and Master's degree students of Mechanical engineering.

**Recommended optional programme components:**
Recommended optional programme components: The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

**Assessment methods and criteria:**
The course uses continuous assessment. The overall grade may be determined, for example, by the weighted average of the learning diary, homework, assignments, seminars, and exam.

**Grading:**
The course utilizes numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University teacher Yrjö Louhisalmi

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521301A: Digital Techniques 1, 8 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Electrical Engineering DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jukka Lahti

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 521412A-02 Digital Techniques 1, Exercise Work 0.0 op
- 521412A Digital Techniques 1 6.0 op
- 521412A-01 Digital Techniques, Exam 0.0 op

**ECTS Credits:**
8

**Language of instruction:**
Finnish

**Timing:**
Periods 3-4

**Learning outcomes:**
1. After the course, students are able to ably binary number system and Boolean algebra in the form of switching algebra to the design and functional analyze of simple digital circuits.
2. In addition, they are also able to use in their designs graphical symbols specified in the dependency notation standard (SFS4612 ja IEEE/ANSI Std.91-1991) and different descriptions of function and structure of state machines.
3. Based on this knowledge, students are able to implement and analyze digital devices consisting of ordinary simple digital components.
4. After having assimilated the basic knowledge of digital technique, students are able to understand also the function and structure of micro controllers and micro processors.

**Contents:**
The principles of digital devices, Boolean algebra, numeral systems, operating principle, analysis and synthesis of combinational logic, flip-flops, operating principle, analysis and synthesis of sequential logic (state machines), physical characteristics of CMOS technology, registers and register transfers, computer memory, instruction set architecture, computer design basics, interfaces and data transmission.

**Mode of delivery:**
Classroom

Learning activities and teaching methods:
Lessons 40 h, weekly home assignments.

Target group:
Primarily 1st year electrical engineering and computer science and engineering BSc students. The course can be taken by the students of the university of Oulu.

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Text books, MIT OpenCourseWare and exercise literature.

Assessment methods and criteria:
Project work and home assignments
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Project work and home assignments are assessed on numerical scale 1-5. The average of project work and home assignments will be the final grade.

Person responsible:
Antti Mäntyniemi

Working life cooperation:
-

Other information:
-

462108S: Mechatronics, 6 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Toni Mikael
Opintokohteen kielet: Finnish
Leikkaavuudet:
  462051S Mechatronics 5.0 op

ECTS Credits:
6 / 160 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during periods III and IV. It is recommended to complete the course at the 4th spring semester.

Learning outcomes:
Upon completion of the course, the student will be able to explain the definition of mechatronics. He/she is able to divide a mechatronic system into its elementary units and he/she is able to explain the significance and interfaces of the various units. The student is able to analyze the kinematic and dynamic properties of mechanisms. Furthermore, the student is able to construct control profiles for actuators driving mechanisms. The student is able to describe the difference between kinematic and inverse kinematic
problem, which he/she can also solve. In addition to this, the student is able to determine the basic structure of a digital control system. He/she is able to evaluate the preconditions for digital control as well as the requirements for hardware.

**Contents:**
Simulation and modelling of mechatronic systems; Actuators suitable for servo control; Basics of control systems; Sensors in closed-loop applications; Determination of control profiles; Kinematics and inverse kinematics of mechanisms.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures 32 h / Group work 16 h / Self-study 112 h

**Target group:**
Master's degree students of mechanical engineering

**Prerequisites and co-requisites:**
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: Machine Sensor Technology

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

**Assessment methods and criteria:**
This course utilizes continuous assessment. The assessment can be based on learning diary, exercises, seminars and exam. The more detailed assessment criteria are available on the Noppa Study Portal.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Lecturer Toni Liedes

*Production engineering*

**463102A: Manufacturing technology I, 5 op**

*Voimassaolo:* 01.08.2015 -
*Opiskelumuoto:* Intermediate Studies
*Laji:* Course
*Vastuuysikkö:* Field of Mechanical Engineering
*Arvostelu:* 1 - 5, pass, fail
*Opettajat:* Pirkola, Heikki Juhani
*Opintokohteen kielet:* Finnish

**Leikkaavuudet:**
- 463053A-01 Manufacturing Technology I, examination 0.0 op
- 463053A-02 Manufacturing Technology I, exe 0.0 op
- 463053A Manufacturing Technology I 3.5 op
- 463053A2 Manufacturing Technology I 5.0 op

**ECTS Credits:**
5 ects/135 hours of work

**Language of instruction:**
Finnish, can be completed in English as a book examination.

**Timing:**
Lectures and exercises take place during the spring periods III - IV.
Learning outcomes:
The objective of the course is to familiarize students with the fundamentals of the functions and manufacturing methods of an engineering workshop. In order to apply manufacturing technology, students must know the features of different alternatives and be able to make technically and economically correct choices and combinations. This course emphasizes practicality and a general view of production. After the course, the student is capable of explaining manufacturing functions and methods of an engineering workshop. He/she is able to select manufacturing methods, machining data, machine tools and tooling equipment. In addition he/she can evaluate the alternatives of production automation in manufacturing functions.

Contents:
Features of different machining methods and machine tools; Selection of a blank machining method and machine tool according to type of work piece, accuracy and volume of production; Costs and technological possibilities of different machining methods; A review of control techniques, programming, jigs and tools

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 40 h and exercises 55 h (10 h of guided teaching). The course will be passed with a final exam and exercises which need to be returned and accepted. The final grade is a combined result of exercises and a final exam.

Prerequisites and co-requisites:
463101A Introduction to Manufacturing Technology

Recommended or required reading:

Assessment methods and criteria:
Teacher gives instructions at the beginning of the course.

Grading:
Numerical grading scale 1-5.

Person responsible:
Heikki Pirkola

521159P: Principles of Digital Fabrication, 5 op

Voimassaoelo: 01.01.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Georgi Georgiev
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay521159P Principles of Digital Fabrication (OPEN UNI) 5.0 op

ECTS Credits:
5 ECTS credits/ 135 hours of work

Language of instruction:
Finnish/English

Timing:
The course will be held in the spring semester, during period IV.

Learning outcomes:
In this course the students will learn the whole process of digital fabrication in FabLab. They will learn how to create an interactive 3D prototype, design mechanical parts for prototype, create basic electronics, implement a control logic for open hardware embedded board, and work in teams on project.

Contents:
The course teaches students to (1) design mechanical components with solid modeling tools, (2) build necessary electronics, and (3) implement software to a microcontroller, to create in FabLab a physical gadget that interacts with the world around it.

Mode of delivery:
Online (Lectures and TA sessions)/ Individual work towards project.

Learning activities and teaching methods:
Lectures 30h / Individual work 123h. There are sessions each week online where guidance is available (min total 16 h).

Target group:
This course is included in the computer science bachelor degree program. It is also available for all degree programs in the university. The course is offered to high-school students.

Prerequisites and co-requisites:

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
There is no recommended or required reading. The tutorials for tools and software (or links to such tutorials) will be provided in the course.

Assessment methods and criteria:
The course will be evaluated on the basis of the project delivered by the teams of students. Essential part of this reporting is the documentation of the project.

Grading:
pass/fail

Person responsible:
Georgi Georgiev

Working life cooperation:
-

Other information:
The course is also offered to high-school students with special study right and gives 5 ECTS credits that can be included in some bachelor’s degrees at University of Oulu.

Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

A440143: Module Preparing for the Major, Process Engineering, 40 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Module Preparing for the Option
477013P: Introduction to Process and Environmental Engineering, 5 op

Voimassaolo: 01.12.2016 - 
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eetu-Pekka Heikkinen
Opintokohteen kielet: Finnish

ECTS Credits:
5 cr / 135 hours of work.

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods I and II. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:
Students can examine industrial processes using the methods and perspectives of process and environmental engineering (e.g. unit operations, material management, phenomenon-based considerations, automation, energy and environment) and they recognize the role of different areas of the process and environmental engineering, when these areas are considered in more detail in the forthcoming courses.

Contents:

Mode of delivery:
Classroom education

Learning activities and teaching methods:
Pair exercises and contact-education that supports these exercises. The amount of classroom education is 16-32 hours the rest being studying independently. Only in Finnish.

Target group:
Students of process and environmental engineering

Prerequisites and co-requisites:
No prerequisites.

Recommended optional programme components:
This course is an introduction to the other courses of process and environmental engineering. Additionally, this course has connections to the course of Technical communication (900060A). It is recommended to complete these courses simultaneously if possible.

Recommended or required reading:
Material will be distributed during lectures and via courses www-site. Students are required to acquire additional material for the exercises.
Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are eight exercises that are made as pair-work. Please note that the course is not organised in English.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
university lecturer Eetu-Pekka Heikkinen

Working life cooperation:
There is no direct working life cooperation in this course.

Other information:
It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

477052A: Fluid Mechanics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ainassaari, Kaisu Maritta
Opintokohteen kielet: Finnish
Leikkaavuudet:
    477301A    Momentum Transfer    3.0 op

ECTS Credits:
5 ECTS / 133 hours of work.

Language of instruction:
Finnish, can be completed in English as a book examination.

Timing:
Implementation in spring semester during 3 rd period. It is recommended to complete the course at the second (Bachelolor's) spring semester.

Learning outcomes:
After the course the student is able to determine the viscosity of pure substances and mixtures and to estimate the effect of temperature and pressure on viscosity. The student is able to recognise the interactions between a solid body and flowing fluid and to distinguish the forces, their directions and to calculate their magnitudes. The student is able to formulate momentum balance equations and to solve these in order to calculate velocity distribution, flow rate and pressure drop. The student is able to distinguish laminar and turbulent flow regimes from others and is able to use the correct equations according to flow regime. After the course the student is able to design pipelines and other simple flow mechanical process equipment.

Contents:

Mode of delivery:
Face-to-face teaching in Finnish. Book examination in English.

Learning activities and teaching methods:
Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:
Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:
Knowledge of solving differential equations.

**Recommended optional programme components:**
The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

**Recommended or required reading:**
or

**Assessment methods and criteria:**
This course utilizes continuous assessment. During the course there are 3 intermediate exams in Finnish. The course can also be completed by final examination
Read more about the course assessment and grading systems of the University of Oulu at [www.oulu.fi/english/studying/assessment](http://www.oulu.fi/english/studying/assessment).

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University teacher Kaisu Ainassaari

**Working life cooperation:**
No

477401A: Thermodynamic Equilibria, 5 op

- **Voimassaolo:** 01.08.2005 -
- **Opiskelumuoto:** Intermediate Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Process and Environmental Engineering
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Eetu-Pekka Heikkinen
- **Opintokohteen kielet:** Finnish
- **Leikkaavuudet:**
  - 470611A Metallurgy Processes 7.0 op

**ECTS Credits:**
5 cr / 135 hours of work.

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd autumn semester.

**Learning outcomes:**
Student is capable of defining chemical equilibria of the systems that are related to industrial processes and understands the relevance of equilibria (and their computational determination) as a part of process analysis, planning and control. Additionally, (s)he can define a meaningful system to be considered in computation thermodynamics; i.e. (s)he can create a computationally solvable problem based on technical problem that in itself is not solvable computationally.

**Contents:**
Concepts of enthalphy (H), entropy (S) and Gibbs free energy (G). The effect of temperature and pressure on H, S and G. Chemical and phase equilibria. Activity and activity coefficient. Calculation of thermodynamic equilibria using equilibrium constant as well as Gibbs free energy minimisation.

**Mode of delivery:**
Classroom education
Learning activities and teaching methods:
Lectures (26 hours), software exercises (4 hours) as well as other exercises. Only in Finnish.

Target group:
Students of process and environmental engineering

Prerequisites and co-requisites:
‘Basic Principles in Chemistry’ and ‘Material and Energy Balances’ or corresponding knowledge is recommended as prerequisite.

Recommended optional programme components:
This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a education that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:
Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:
Students are required to make a portfolio consisting of a learning diary and exercises. Please note that the course is organised only in Finnish.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Eetu-Pekka Heikkinen

Working life cooperation:
There is no direct working life cooperation in this course.

Other information:
It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

477221A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Marja Mikola
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay477231A Material and Energy Balances I (OPEN UNI)  2.0 op
  ay477232A Material and Energy Balances II (OPEN UNI)  3.0 op
  ay477221A Material and Energy Balances (OPEN UNI)  5.0 op
  477201A Material and Energy Balances  5.0 op
  470220A Fundamentals of Chemical Process Engineering  5.0 op

ECTS Credits:
5 ECTS /133 hours of work

Language of instruction:
Finnish. The course can be completed in English as a book examination.

Timing:
Spring periods 3 and 4.
Learning outcomes:
The student is able to formulate material and energy balances for a process by taking into account the restrictions set by reaction stoichiometry. The student knows how the created mathematical formulation can be exploited in process consideration.

Contents:
Formulation of material and energy balances by taking into account the effects of chemical reactions. Multiunit cases are also considered.

Mode of delivery:
Lectures and group exercise

Learning activities and teaching methods:
Lectures 40h, group work 10h and self-study 80h

Target group:
Bachelor students in of Process or Environmental Engineering, minor subject students in relevant disciplines.

Prerequisites and co-requisites:
High school level chemistry, mathematics and physics.

Recommended optional programme components:
The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Assessment methods and criteria:
During the course, there are two intermediate exams and both of them must be passed. Alternatively student can participate in final exam after the course. In addition to this, the students will be making a group exercise, which will be evaluated.

Person responsible:
Juha Ahola

Other information:
This course replaces the course 477201A Material and Energy Balances, 5 ects.

477323A: Mass and Heat Transfer, 5 op

Voimassaalo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ainassaari, Kaisu Maritta
Opintokohteen kielet: Finnish
Leikkaavuudet:
477322A  Heat and Mass Transfer  5.0 op

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
Finnish, can be completed in English as a book examination.

Timing:
Implementation in autumn semester during 1st period. It is recommended to complete the course at the third (Bachelor's) autumn semester.

Learning outcomes:
After passing the course the student knows what happens when heat is transferred by conduction, convection and radiation. The student can describe energy transfer with differential energy balances connected with momentum balances; in macro scale the student is able to solve practical heat transfer problems by correlating heat transfer coefficients to dimensionless flow and material characteristics; With the help of these transfer coefficients the student is capable of estimating the size of heat transfer equipment, especially heat exchangers and select the most suitable and profitable types; and to Sketch large heat nets and to diminish the costs of the equipments.

The student is able to use the pinch method which optimises the number of heat exchangers and total energy consumption. He/she is also able to apply the exergy principle to make work from thermal energy. With the aid of this principle he/she will be able to divide the costs of the used energy in right proportion based on the processing stage. He/she student is able to explain diffusion as a phenomenon and the factors affecting it. He/she is able to model mass transfer in simple systems by using the theory of Fick. The student is capable of modeling diffusion by differential mass balances. He/she recognises the special features of mass transfer in turbulent systems and the role of different transport phenomena in mass transfer equipment. He/she has rudimentary practical skills applicable to the scale-up of the equipment used for absorption.

Contents:

Mode of delivery:
Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:
Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:
Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:
Knowledge of solving differential equations.

Recommended optional programme components:
The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment. During the course there are 4 intermediate exams. The course can also be completed by final examination.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Kaisu Ainassaari

Working life cooperation:
No

Other information:
Replaces the course 477322A Lämmön ja aineensiirto, 5 ects.

Process engineering

477121A: Particle Technology, 5 op

Voimassaolo: 01.08.2015 - 31.07.2022
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohteen kielet: Finnish
Leikkaavuudet:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>477120A</td>
<td>Fluid and Particle Engineering</td>
<td>5.0 op</td>
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<tr>
<td>477101A</td>
<td>Fluid and Particle Engineering I</td>
<td>3.0 op</td>
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</tbody>
</table>

ECTS Credits:
5 ECTS / 133 h of work

Language of instruction:
Finnish

Timing:
Implementation in spring term, period 4.

Learning outcomes:
Upon completion of the course, a student should be able to identify the mainline mechanical processes in process industry enhancing the degree of upgrading, as well as recovery operations related to those mechanical main processes. The student is able to identify the equipment related to the mechanical processes and can explain their purpose of use and their operational principles.

Contents:
Granular material and sampling, particle size and particle size distribution, specific surface area, basics in grinding, crushing, sieving and mineral concentration, froth flotation, mineral concentration methods.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
The implementation methods of the course are varying. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works or with web learning.

Target group:
Bachelor students in process and environmental engineering

Prerequisites and co-requisites:
477013P Introduction to process and environmental engineering

Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:
This course utilizes continuous assessment including two intermediate exams with group and/or homework. Alternatively, the course can also be completed by taking the end exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
No

477122A: Bulk Solids Handling, 5 op

Voimassaolo: 01.08.2015 - 31.07.2023
Opiskelumuoto: Intermediate Studies
Laji: Course
Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisa Koivuranta

Opintokohteen kielet: Finnish

Leikkaavuudet:

- 477120A Fluid and Particle Engineering 5.0 op
- 477102A Bulk Solids Handling 4.0 op

ECTS Credits:
5 ECTS / 133 h of work

Language of instruction:
Finnish

Timing:
Implementation in period 2 (autumn term).

Learning outcomes:
Upon completion of the course, a student should be able to identify auxiliary mechanical unit processes as well as equipment and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
The implementation methods of the course vary. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works or with web learning.

Target group:
Bachelor students in process or environmental engineering

Prerequisites and co-requisites:
477101A Particle Technology

Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures

Assessment methods and criteria:
This course utilizes continuous assessment.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
No

477222A: Reactor Analysis, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Marja Mikola
Opintokohteen kielet: Finnish

Leikkaavuudet:

477202A  Reactor Analysis  4.0 op

ECTS Credits:
5 ECTS /133 hours of work

Language of instruction:
Finnish

Timing:
Period 2 (autumn term)

Learning outcomes:
By completing the course the student is able to explain the determination methods of the reaction rate from experimental data and he/she can illustrate the basics of deterministic modelling. On that basis, the student has skills to analyse the behaviour of ideal reactors and to perform initial reactor selection and sizing.

Contents:

Mode of delivery:
Lectures and small group exercises

Learning activities and teaching methods:
Lectures about 30 h, exercises about 10 h and self-study about 90 h.

Target group:
Bachelor students in process and environmental engineering, minor subject students

Prerequisites and co-requisites:
Objectives of Material and Energy Balances and Thermodynamic Equilibrium

Recommended optional programme components:
-

Recommended or required reading:
Lecture handouts
Levenspiel, O.: Chemical Reaction Engineering. John Wiley & Sons, 1972. or newer (parts)

Assessment methods and criteria:
Two midterm exams during the course, which can be replaced with final exam after the course and two exercises.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Marja Mikola

Working life cooperation:
No

Other information:
-

Automation engineering

477051A: Automation Engineering, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
**Vastuuysikkö:** Field of Process and Environmental Engineering  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Hiltunen, Jukka Antero  
**Opintokohteen kielet:** Finnish  

**Leikkaavuudet:**  
477601A Process Automation Systems 4.0 op

**ECTS Credits:**  
5 ECTS /133 h of work

**Language of instruction:**  
Finnish

**Timing:**  
Autumn, period 2

**Learning outcomes:**  
Students learn how to use PI diagrams, field instruments, automation systems and PLCs in design, implementation and commissioning projects. Students can configure and program the basic automation functions in DCSs and PLCs.

**Contents:**  
The operational and structural descriptions and concepts of process automation, automation commissioning projects, PI diagrams and field devices, configuration tools for automation functions, logic programming, telecommunication technology in automation, field buses, examples of commercial DCSs, PLCs and field bus systems.

**Mode of delivery:**  
Face-to-face teaching

**Learning activities and teaching methods:**  
Lectures, demonstrations, configuration and logic programming exercises, excursion to a neighbouring industrial plant

**Target group:**  
B.Sc. students in process and environmental engineering

**Prerequisites and co-requisites:**  
477011P Introduction to process and environmental engineering I and 448010P Introduction to process and environmental engineering II are recommended.

**Recommended or required reading:**  
Lecture notes and handouts, manuals/handbooks

**Assessment methods and criteria:**  
Learning diary or examination

**Grading:**  
Numerical grading scale 1-5 or fail

**Person responsible:**  
Jukka Hiltunen and Aki Sorsa

**Working life cooperation:**  
No

477502A: Experiment design and analysis, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Process and Environmental Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Aki Sorsa
Opintokoheen kielet: Finnish

Leikkaavuudet:
470432A Process Control Engineering II 5.0 op

ECTS Credits:
5 ECTS /133 hours of work

Language of instruction:
Finnish

Timing:
Implementation in the 4th period on the spring term.

Learning outcomes:
After the course, the student knows different experimental design methods and their applicability for different problems. He can also design experiments for multi-variable processes and analyze the results. He can also use some basic means to visualize the results got from experimental data and choose proper tools for experiment design problems.

Contents:
Systematic design of process experiments with matrix techniques (Hadamard, Central Composite Design). Graphical and statistical analysis of experimental data. Correlation, regression and variance analysis.

Mode of delivery:
Lectures and extensive exercise work

Learning activities and teaching methods:
Lectures during one period

Target group:
Bachelor’s students in process and environmental engineering

Prerequisites and co-requisites:
Course Process Dynamics is recommended beforehand.

Recommended optional programme components:
The course forms a basis to the advanced courses in the field of control engineering.

Recommended or required reading:

Assessment methods and criteria:
Homework and written/oral test. It is recommended to take the course also according to the principle of continuous evaluation.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:
Aki Sorsa

Working life cooperation:
No

477501A: Process dynamics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Aki Sorsa
Opintokohteen kielet: Finnish
Leikkaavuudet:

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<td>Process Control Engineering I</td>
<td>5.0 op</td>
</tr>
<tr>
<td>470431A</td>
<td>Process Control Engineering I</td>
<td>5.0 op</td>
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ECTS Credits:
5 ECTS /133 hours of work

Language of instruction:
Finnish/English. The main lecturing language is Finnish, but the course can also be taken in English with some special arrangements. Contact the responsible person.

Timing:
Negotiable (for the English version).

Learning outcomes:
After the course, the student understands the basic principles of dynamical behaviour of different processes, can write dynamic mass and energy balances for unit processes, and can solve these with the help of the transfer function approach. He knows also the connection between process control and process dynamics.

Contents:
Basics of process models and dynamics. Dynamic models. Lumped and distributed parameter models. Practical examples of different unit processes such as chemical reactors and heat exchangers. Modelling of large-scale processes.

Mode of delivery:
Negotiable (the course can be taken in English with some special arrangements - contact the responsible person).

Learning activities and teaching methods:
Solving exercise problems; textbook.

Target group:
Exchange and other international students (for the English version).

Prerequisites and co-requisites:
No course requirements.

Recommended optional programme components:
The course forms a basis to the advanced courses in the field of control engineering.

Recommended or required reading:
Lecture handout and other material distributed at the lecture.

Assessment methods and criteria:
Homework and written/oral test

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:
Aki Sorsa

Working life cooperation:
No
A440142: Module Preparing for the Major, Civil Engineering, 40 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Antti Niemi
Opintokohteen kielet: Finnish

Electives

485201A: Building information modeling and CAD, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Antti Niemi
Opintokohteen kielet: Finnish

ECTS Credits:
5 ETCS / 135 hours of work
Language of instruction:
Finnish
Timing:
The course is held in the spring semester, during period 4.
Learning outcomes:
Upon completion of the course, student will know the basics of computer-aided modeling and design. The course enables application and development of modeling and design applications and further development as an independent user of various modeling systems and platforms.
Contents:
Mode of delivery:
Face-to-face and independent study.
Learning activities and teaching methods:
Lectures and exercises 30 h, independent study and project work 105 h.
Target group:
Bachelor level students in the degree program of civil engineering.
Prerequisites and co-requisites:
Basic course in mathematics.

**Recommended optional programme components:**
The course supports advanced courses in civil engineering.

**Recommended or required reading:**
Lecture and exercise material.

**Assessment methods and criteria:**
Continuous assessment of exercise work and home work.

**Grading:**
Passed/fail

**Person responsible:**
Antti H. Niemi and Pekka Rossi

**Working life cooperation:**
-

**Other information:**
-

461102A: Statics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lahtinen, Hannu Tapio
Opintokohteen kielet: Finnish

Leikkaavuudet:
- ay461102A Statics (OPEN UNI) 5.0 op
- 461016A-01 Statics, examination 0.0 op
- 461016A-02 Statics, exercises 0.0 op
- 461016A Statics 5.0 op

**ECTS Credits:**
5 ETCS / 149 hours of work

**Language of instruction:**
Lectures in finnish, foreign students follow the course by reading independently the books in english and taking part to the exercises and exams where all material is given in english.

**Timing:**
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester.

**Learning outcomes:**
After the course, the student can calculate forces and moments of loaded structures using equations of vector algebra and trigonometry. He/she can draw a free body diagram of the force system and then solve the unknown forces by using equations of equilibrium. He/she can determine resultants from uniformly distributed loads and apply Coulomb's law of friction in the problem equilibrium. The student can solve problems of internal and external forces of particle systems and rigid body systems in case of static equilibrium. Especially, he/she can draw shear force and bending moment diagrams for beam structures.

**Contents:**
Fundamental laws and concepts in statics. Force systems and their treatment. Equilibrium of particles and rigid bodies. Static forces in isostatic structures such as beams, frames, cables and trusses. Friction.

**Mode of delivery:**
Implemented as Face-to-face -teaching.
Learning activities and teaching methods:
Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

Target group:
Compulsory for candidate degree students of mechanical engineering programme.

Prerequisites and co-requisites:
Now prerequisites required.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Hannu Lahtinen

Other information:
The course gives ability for understanding static equilibrium, ability for determining force balance in structures and readiness for later studies.

461103A: Strength of materials I, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lahtinen, Hannu Tapio
Opintokohteen kielet: Finnish
Leikkaavuudet:
  461010A-01 Strength of Materials I, examination 0.0 op
  461010A-02 Strength of Materials I, exercises 0.0 op
  461010A Strength of Materials I 7.0 op

ECTS Credits:
5 ETCS / 149 hours of work

Language of instruction:
Lectures in Finnish, foreign students follow the course by reading independently the books in English and taking part to the exercises and exams where all material is given in English.

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:
After the course, the student can determine stresses and strains of structures under loading. He/she can change the general stress and strain states from one coordinate system to another and can also apply constitutive equations in calculations. The student can dimension typical structures such as tension and compression bars, torsion bars and straight beams.
Contents:

Mode of delivery:
Implemented as Face-to-face teaching.

Learning activities and teaching methods:
Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

Target group:
Compulsory for Bachelor's degree students of mechanical engineering programme.

Prerequisites and co-requisites:
The recommended preceding course is 461102A Statics.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Hannu Lahtinen

Other information:
The course looks into the most important principal concepts of strength of materials and gives ability for dimensioning of simple structures such as straight bars in tension, compression or torsion loads and straight beams under bending moments.

485101A: Introduction to building construction, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Hannu Tapani
Opintokohteen kielet: Finnish
Leikkaavuudet:
  466101A Introduction to building construction 5.0 op
  460116A-01 Introduction to Construction Engineering, examination 0.0 op
  460116A-02 Introduction to Construction Engineering, exercise work 0.0 op
  460116A Introduction to Building Construction 3.0 op

Ei opintojaksokuvausia.

466102A: Introduction to structural design, 3 - 5 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Hannu Tapani
Opintokohteen kielet: Finnish
Leikkaavuudet:
485102A Introduction to structural design  5.0 op
460117A-01 Introduction to Structural Design, examination  0.0 op
460117A-02 Introduction to Structural Design, exercise work  0.0 op
460117A Introduction to Structural Design  6.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Autumn semester, periods 1-2
Course 485102A replaces this course in academic year 2020-2021.

Learning outcomes:
After completing the course the student is able to name technical regulations and instructions, which guide construction. After completing the course students can explicate principle of verifications and plastic theory on structure design and also different loads on structure. Student estimate design loads by calculation and design load effect in structures. Student can describe different structure and bracing systems.

Contents:
Regulations and supervising. The principle of design verification. The loads and effect. The principle of using of eurocode. The principle of plastic theory on on structure design. Structure systems. The joints of structures.

Mode of delivery:
Lecture room teaching.

Learning activities and teaching methods:
Lectures and exercises

Target group:
Students studying structural engineering

Prerequisites and co-requisites:
461016A Statics and 460101A Strength of Materials I

Recommended or required reading:
Lecture notes (mainly in Finnish), Finnish law and legislation, National building code of Finland, Eurocode standards

Assessment methods and criteria:
Passed practical works and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
University teacher Hannu Liedes

Other information:
This course will replace course 485102A in Academic year 2020-21.
Voimassaolo: 01.08.2018 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Hannu Tapani
Opintokohteen kielet: Finnish

Leikkaavuudet:

488119A Basics of infrastructure planning and development 5.0 op
466113S Construction economics 5.0 op
460165A-02 Introduction to Construction Economics I, practical work 0.0 op
460165A-01 Introduction to Construction Economics I, examination 0.0 op

ECTS Credits:
5 ECTS

Language of instruction:
Finnish

Person responsible:
Hannu Liedes

Other information:
This Course replaces courses 466113S and 488119A.

485301A: Basics of Geotechnics, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

488115A Geomechanics 5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course unit is held in the autumn semester, during period 1

Learning outcomes:
Upon completion this course, the student will understand the fundamentals of Soil mechanics, foundation engineering and soil freezing and thawing.

Contents:
Origins and composition of soils, classification of soils, stress and strains in soils, mechanical properties of soils, bearing capacity of foundations, seepage analyses, freezing and thawing of soils, site investigations and in situ testing.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (30 h) and calculation exercises (10 h) also independent work (95 h)
**Target group:**
Students in Bachelor programs of civil engineering and environmental engineering

**Prerequisites and co-requisites:**
No

**Recommended optional programme components:**
-

**Recommended or required reading:**
Lecture handout and other materials delivered in lectures, *Principles of Geotechnical Engineering* by Das B. M.

**Assessment methods and criteria:**
Examination

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Anne Tuomela

**Working life cooperation:**
No

**Other information:**
This course will replace course 488115A Geomechanics in Academic year 2020-21.

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**485103A: Building physics, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Filip Fedorik
**Opintokohteen kielet:** English

**Leikkaavuudet:**
- 466111S Building physics 5.0 op
- 460160S-01 Building Physics, examination 0.0 op
- 460160S-02 Building Physics, exercises 0.0 op
- 460160S Building Physics 3.5 op

**ECTS Credits:**
5 ECTS credits / 132 hours of work

**Language of instruction:**
English

**Timing:**
Autumn, Periods 1-2

**Learning outcomes:**
After completing the course the student can explain basic phenomenon of building physics. The student can analyse and describe heat, air and moisture transfer in buildings and also explain main causes of typical moisture damages. The student can explain factors affecting energy efficiency and can calculate the energy efficiency number. The student knows the calculation methods in acoustics.

**Contents:**

**Mode of delivery:**
Face-to-face and distance learning

Learning activities and teaching methods:
Lectures, exercises, case studies, and self directed learning

Target group:
Students studying structural engineering

Prerequisites and co-requisites:
466101A Introduction to building construction

Recommended or required reading:
The material that is in English will be distributed at the lectures
1) Lecture notes (mainly in Finnish)
2) Suomen rakentamismääräyskokoelman osatC1, C2, C3, C4 ja D3.

Assessment methods and criteria:
Exercises and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
university lecturer Raimo Hannila

Other information:
This course will replace course 466111S Building Physics in Academic year 2020-21.

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op
Voimassaolo: 01.08.2015 - 
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

A440144: Module Preparing for the Major, Environmental Engineering, 40 op
Voimassaolo: 01.08.2015 - 
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Electives

477013P: Introduction to Process and Environmental Engineering, 5 op
Voimassaolo: 01.12.2016 - 
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eetu-Pekka Heikkinen
Opintokohteen kielet: Finnish

ECTS Credits:
5 cr / 135 hours of work.

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods I and II. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:
Students can examine industrial processes using the methods and perspectives of process and environmental engineering (e.g. unit operations, material management, phenomenon-based considerations, automation, energy and environment) and they recognize the role of different areas of the process and environmental engineering, when these areas are considered in more detail in the forthcoming courses.

Contents:

Mode of delivery:
Classroom education

Learning activities and teaching methods:
Pair exercises and contact-education that supports these exercises. The amount of classroom education is 16-32 hours the rest being studying independently. Only in Finnish.

Target group:
Students of process and environmental engineering

Prerequisites and co-requisites:
No prerequisites.

Recommended optional programme components:
This course is an introduction to the other courses of process and environmental engineering. Additionally, this course has connections to the course of Technical communication (900060A). It is recommended to complete these courses simultaneously if possible.

Recommended or required reading:
Material will be distributed during lectures and via courses www-site. Students are required to acquire additional material for the exercises.

Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are eight exercises that are made as pair-work. Please note that the course is not organised in English.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
university lecturer Eetu-Pekka Heikkinen

Working life cooperation:
There is no direct working life cooperation in this course.

Other information:
It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

477401A: Thermodynamic Equilibria, 5 op
ECTS Credits:
5 cr / 135 hours of work.

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd autumn semester.

Learning outcomes:
Student is capable of defining chemical equilibria of the systems that are related to industrial processes and understands the relevance of equilibria (and their computational determination) as a part of process analysis, planning and control. Additionally, (s)he can define a meaningful system to be considered in computation thermodynamics; i.e. (s)he can create a computationally solvable problem based on technical problem that in itself is not solvable computationally.

Contents:
Concepts of entalphy (H), entropy (S) and Gibbs free energy (G). The effect of temperature and pressure on H, S and G. Chemical and phase equilibria. Activity and activity coefficient. Calculation of thermodynamic equilibria using equilibrium constant as well as Gibbs free energy minimisation.

Mode of delivery:
Classroom education

Learning activities and teaching methods:
Lectures (26 hours), software exercises (4 hours) as well as other exercises. Only in Finnish.

Target group:
Students of process and environmental engineering

Prerequisites and co-requisites:
'Basic Principles in Chemistry' and 'Material and Energy Balances' or corresponding knowledge is recommended as prerequisite.

Recommended optional programme components:
This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a education that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:
Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:
Students are required to make a portfolio consisting of a learning diary and exercises. Please note that the course is organised only in Finnish.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Eetu-Pekka Heikkinen

Working life cooperation:
There is no direct working life cooperation in this course.

Other information:
It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

477052A: Fluid Mechanics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ainassaari, Kaisu Maritta
Opintokohteen kielet: Finnish
Leikkaavuudet:

477301A Momentum Transfer 3.0 op

ECTS Credits:
5 ECTS / 133 hours of work.

Language of instruction:
Finnish, can be completed in English as a book examination.

Timing:
Implementation in spring semester during 3rd period. It is recommended to complete the course at the second (Bachelor's) spring semester.

Learning outcomes:
After the course the student is able to determine the viscosity of pure substances and mixtures and to estimate the effect of temperature and pressure on viscosity. The student is able to recognise the interactions between a solid body and flowing fluid and to distinguish the forces, their directions and to calculate their magnitudes. The student is able to formulate momentum balance equations and to solve these in order to calculate velocity distribution, flow rate and pressure drop. The student is able to distinguish laminar and turbulent flow regimes from others and is able to use the correct equations according to flow regime. After the course the student is able to design pipelines and other simple flow mechanical process equipment.

Contents:

Mode of delivery:
Face-to-face teaching in Finnish. Book examination in English.

Learning activities and teaching methods:
Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:
Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:
Knowledge of solving differential equations.

Recommended optional programme components:
The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:
or
Assessment methods and criteria:
This course utilizes continuous assessment. During the course there are 3 intermediate exams in Finnish. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Kaisu Ainassaari

Working life cooperation:
No

477221A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Marja Mikola
Opintokohteen kielet: Finnish

Leikkaavuudet:
ay477231A Material and Energy Balances I (OPEN UNI) 2.0 op
ay477232A Material and Energy Balances II (OPEN UNI) 3.0 op
ay477221A Material and Energy Balances (OPEN UNI) 5.0 op
477201A Material and Energy Balances 5.0 op
470220A Fundamentals of Chemical Process Engineering 5.0 op

ECTS Credits:
5 ECTS /133 hours of work

Language of instruction:
Finnish. The course can be completed in English as a book examination.

Timing:
Spring periods 3 and 4.

Learning outcomes:
The student is able to formulate material and energy balances for a process by taking into account the restrictions set by reaction stoichiometry. The student knows how the created mathematical formulation can be exploited in process consideration.

Contents:
Formulation of material and energy balances by taking into account the effects of chemical reactions. Multiunit cases are also considered.

Mode of delivery:
Lectures and group exercise

Learning activities and teaching methods:
Lectures 40h, group work 10h and self-study 80h

Target group:
Bachelor students in of Process or Environmental Engineering, minor subject students in relevant disciplines.

Prerequisites and co-requisites:
High school level chemistry, mathematics and physics.
Recommended optional programme components:
The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Assessment methods and criteria:
During the course, there are two intermediate exams and both of them must be passed. Alternatively student can participate in final exam after the course. In addition to this, the students will be making a group exercise, which will be evaluated.

Person responsible:
Juha Ahola

Other information:
This course replaces the course 477201A Material and Energy Balances, 5 ects.

477323A: Mass and Heat Transfer, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ainassaari, Kaisu Maritta
Opintokohteen kielet: Finnish
Leikkaavuudet: 477322A Heat and Mass Transfer 5.0 op

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
Finnish, can be completed in English as a book examination.

Timing:
Implementation in autumn semester during 1st period. It is recommended to complete the course at the third (Bachelor's) autumn semester.

Learning outcomes:
After passing the course the student knows what happens when heat is transferred by conduction, convection and radiation. The student can describe energy transfer with differential energy balances connected with momentum balances; In macro scale the student is able to solve practical heat transfer problems by correlating heat transfer coefficients to dimensionless flow and material characteristics; With the help of these transfer coefficients the student is capable of estimating the size of heat transfer equipment, especially heat exchangers and select the most suitable and profitable types; and to Sketch large heat nets and to diminish the costs of the equipments. The student is able to use the pinch method which optimises the number of heat exchangers and total energy consumption. He/she is also able to apply the exergy principle to make work from thermal energy. With the aid of this principle he/she will be able to divide the costs of the used energy in right proportion based on the processing stage. He/she student is able to explain diffusion as a phenomenon and the factors affecting it. He/she is able to model mass transfer in simple systems by using the theory of Fick. The student is capable of modeling diffusion by differential mass balances. He/she recognises the special features of mass transfer in turbulent systems and the role of different transport phenomena in mass transfer equipment. He/she has rudimentary practical skills applicable to the scale-up of the equipment used for absorption.

Contents:
Mechanism of heat transfer. Creating and solving differential energy balances. Heat transfer coefficient. Macroscopic balances. Selection of a proper type of heat exchanger. Scale-up and design of a heat...

Mode of delivery:
Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:
Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:
Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:
Knowledge of solving differential equations.

Recommended optional programme components:
The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment. During the course there are 4 intermediate exams. The course can also be completed by final examination.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Kaisu Ainassaari

Working life cooperation:
No

Other information:
Replaces the course 477322A Lämmön ja aineensiirto, 5 ects.

488102A: Hydrological Processes, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay488102A Hydrological Processes (OPEN UNI) 5.0 op
480207A Hydraulics and Hydrology 5.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish, but also option to complete the course in English.

Timing:
The course is held in the autumn semester during the period 1. It is recommended to complete the course at the 1st autumn semester of the international master program of environmental engineering.
Learning outcomes:
After the course, the student understands and can describe the main hydrological processes, water movements and hydraulics phenomenon quantitatively through mathematical methods. The student also understands and quantifies the relation between state and flow with relation to snowmelt, evaporation, infiltration and groundwater flow.

Contents:
Hydrological cycle, physical properties of water, distribution of water resources, water balance, precipitation, evapotranspiration, soil and ground water, infiltration, runoff, snow hydrology, hydrometry, water quality of rivers and lakes.

Mode of delivery:
Face-to-face teaching and independent work with two assignment reports.

Learning activities and teaching methods:
Lectures 24 h, exercises 16 h and independent work 93 h. Totally 133 h.

Target group:
Students in international master programs of environmental engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following course or having corresponding knowledge prior to enrolling for the course unit: 477201A Material and Energy Balances and 477052A Fluid mechanics.

Recommended optional programme components:
The course is a prerequisite for most of master level studies.

Recommended or required reading:

Assessment methods and criteria:
The assignments must be returned and passed with threshold of 50% in order to get final examination. The final grade of the course is weighted average of assignment reports (80%) and examination (20%).

Grading:
The assignments must be returned and passed with threshold of 50% in order to get final examination. The final grade of the course is weighted average of assignment reports (80%) and examination (20%).

Person responsible:
University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:
Examples sollev in the lectures based on real problems

Other information:
The English version of the course is organized parallel to Finnish version of the course.

488210A: Environmental science and technology, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Väisänen, Virpi Maria
Opintokohteen kielet: Finnish
Leikkaavuudet:
488201A Environmental Ecology 5.0 op
488505A: Waste management and recycling, 5 op

Voimassaolo: 01.09.2018 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jenni Ylä-Mella, Eva Pongracz
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5 cr/133 hours of work
Language of instruction:
English
Timing:
Spring, period 3-4.
Learning outcomes:
After completing the course, the student will be familiar with the waste legislation and other policy instruments and is able to use the waste-related terminology. The student understands the responsibilities of the different actors and stakeholders in the municipal waste management system and knows the key waste minimization and recycling requirements. The student will also be familiar with the municipal waste collection system for households and able to calculate the recycling and recovery rates of recyclables. The student knows the key recycling technologies for the main waste fractions and can calculate treatment costs for the major streams.

Contents:

Mode of delivery:
Distance learning, starting 22.1.2021 in zoom. More detailed instructions for those who registered by e-mail on 21.1.2021. Lectures, lecture assignments and an exercise in Moodle. The course has compulsory assignment requirements and the course evaluation will be based on the grades of intermediate tasks. No exam.

Learning activities and teaching methods:
Online and video lectures; lecture assignments and an exercise as a personal work.

Target group:
Master’s students of process and environmental engineering; Bachelor’s students of environmental engineering; Minor subject students.

Recommended or required reading:
Video lectures and information on recommended reading material will be provided during the course.

Assessment methods and criteria:
Continuous evaluation. Completion of all personal lecture assignments and the exercise during the course are mandatory.

Grading:
The evaluation is based on personal lecture assignments and an exercise during the course. Each intermediate task must be passed, and the scores obtained from assignments forms the final grade. The course uses a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.
Person responsible:
D.Sc.(Tech.) Jenni Ylä-Mella

Other information:
This course replaces the course 488130A Waste management and resources recovery.
The course can also be taken in Finnish in autumn term period 1. (See the course description in Finnish.)

555205M: Engineering studies in other Universities/Institutes, 0 - 30 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

A400072: Module Preparing for the Option, 20 - 40 op

Voimassaalo: 01.08.2007 -
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuysikkö: Faculty of Technology
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

555206M: Elective studies in other Universities/Institutes, 0 - 30 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

A440171: Optional Studies, Bachelor of Science (Industrial Engineering and Management), 0 - 20 op

Voimassaalo: 01.08.2005 -
Opiskelumuoto: Optional Studies
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
IEM electives

555214A: Working in the university community, 5 op

Voimassaolo: 01.01.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits

Language of instruction:
Finnish / English

Timing:
Periods 1-4

Learning outcomes:
Upon completion of the course, the student will be able to:
• apply the skills required for the tasks in the university community (communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills)
• take responsibility for the tasks in a responsible manner
• analyse and find development targets related to the tasks

Contents:
Communication, collaboration, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills.

Mode of delivery:
The tuition will not be organised.

Learning activities and teaching methods:
Students complete tasks with their own activities to support the university community and their own professional growth.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management or similar knowledge.

Recommended optional programme components:
-

Recommended or required reading:
-

Assessment methods and criteria:
The course can include several tasks as follows: Student Union 2 years 2 ECTS, University Board 1 year 2 ECTS, University Collegial Body 2 years 2 ECTS, Education Council 1 year 2 ECTS, Education Management Team 1 year 2 years, Faculty Management Team 1 year 2 ECTS, Faculty Board 2 years 2 ECTS, Faculty Education Council 2 years 2op, Student Union Board 1 year 1-3 ECTS, National Student Organisation 1 year 1-5 ECTS, Other major education policy and / or teaching development tasks 1-3 ECTS credits, Student Tutor or Teaching Assistant 2 ECTS cr.
The student writes a report on conducting the tasks, which includes the following: 1) In which positions did the student work, how long and how actively he/she participated? (0.5 pages). 2) What does the student
think he/she has learned from the duties and how can the experience be utilized in the future? In particular, these skills should be considered: communication, co-operation, creativity, problem-solving, project management, learning, technical skills, international skills, commercial and financial skills and the development of self-knowledge (1 page). 3) How would the student think that the activity could be developed by the methods of industrial engineering and management? (1.5 pages). A report and a certificate on the tasks will be returned to the teacher tutor, who determines the number of credits to be awarded. The length of the report is 3 pages.

Grading:
pass / fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
-

555215A: Working life project, 5 op

Voimassaolo: 01.01.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits

Language of instruction:
Finnish / English

Timing:
Periods 1-4

Learning outcomes:
Upon completion of the course, the student will be able to:
- apply the skills required for the tasks in the working life (communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills)
- take responsibility for the project in a responsible manner
- analyse and find development targets related to the project

Contents:
Communication, collaboration, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills.

Mode of delivery:
The tuition will not be organised.

Learning activities and teaching methods:
Students complete tasks with their own activities to support their own professional growth.

Target group:
Industrial Engineering and Management students

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management or similar knowledge.
Recommended optional programme components: 
-
Recommended or required reading: 
-
Assessment methods and criteria: 
Participation in a project, competition or similar organized by the academic community, and with a linkage to business life (e.g. Accenture innovation challenge, ESTIEM Times).

The student writes a report on participation in the project, consisting of:
1) In which project did the student work, when and what was the project scope? (0.5 pages).
2) What does the student think he/she has learned from the duties and how can the experience be utilized in the future? In particular, these skills should be considered: communication, co-operation, creativity, problem-solving, project management, learning, technical skills, international skills, commercial and financial skills and the development of self-knowledge (1 page).
3) How did the project succeed and how the project could be developed using IEM methods? (1.5 pages).

A report and a certificate of project completion will be returned to the teacher tutor, who determines the number of credits to be awarded.

Grading:
pass / fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
-

555200A: Bachelor's Thesis / Industrial Engineering and Management, 8 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kieleet: Finnish

ECTS Credits:
8 ECTS credits.

Language of instruction:
Finnish. The thesis can also be written in English.

Timing:
Periods 1-4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- solve small problems in organisations independently
- create a research plan, define a research problem and research questions and manage his/her own work according to the research plan
- give a justified solution or proposals
- utilise the latest research information in the field and can critically evaluate the information obtained
- create a written report according to the instructions

Contents:
The research topics are presented in the bachelor’s thesis seminar. The student can also propose an appropriate topic for the thesis.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Self-study 216 h. The student defines the research topic in co-operation with the instructor. The thesis can be a theoretical or empirical study.

**Target group:**  
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**  
900061A Scientific Communication for Industrial Engineering and Management, 555204A Internship.

**Recommended optional programme components:**  
The students will complete 555201A Bachelor’s thesis seminar simultaneously.

**Recommended or required reading:**  
The instructions and forms related to bachelor’s thesis are available at Oulu University's webpage "Bachelor thesis".

**Assessment methods and criteria:**  
This course includes writing a 25-page thesis. The work is assessed by using the thesis assessment form.

**Grading:**  
Pass-Fail

**Person responsible:**  
University lecturer Osmo Kauppila

**Working life cooperation:**  
Research topic / problem can be the examining and solving of the real problem of company or organisation.

**Other information:**  
The general instructions related to thesis, matury test and graduation are available at the Oulu University's webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.

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**555201A: Bachelor’s Thesis Seminar, 2 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Henna Longi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**  
2 ECTS credits.

**Language of instruction:**  
Finnish. English material is also used.

**Timing:**  
The course is organized in the autumn and spring semester.

**Learning outcomes:**  
Upon completion of the seminar, student is able to:
- set and define research problem and objectives
- conduct a minor research as a literature review or empirical research
- apply the selected research methods and write an academic report
- evaluate and review academic reports and act as an opponent.

**Contents:**  
Information retrieval for the research, conduct research in practice, scientific writing, acting as an opponent.

**Mode of delivery:**  
The tuition will be implemented as face-to-face teaching. Partial independent work is possible if the bachelor's thesis is carried out during the summer time.

**Learning activities and teaching methods:**  
Lectures 12 h, self-study 42 h.

**Target group:**  
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**  
030005P Information Skills, 900061A Scientific Communication for Industrial Engineering and Management, 555204A Internship

**Recommended optional programme components:**  
The students will complete 555200A Bachelor’s Thesis simultaneously. If course 030005P Information Skills is not completed, it can be completed simultaneously.
**Recommended or required reading:**
The materials will be defined at the beginning of the course.

**Assessment methods and criteria:**
Active participation in the seminar, presenting one’s own bachelor’s thesis, and acting as an opponent in the seminar.

**Grading:**
Pass-Fail.

**Person responsible:**
MSc Henna Longi

**Working life cooperation:**
No.

**Other information:**
The general instructions related to thesis, matury test and graduation are available at the Oulu University's webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.

**555202A: Maturity Test / Bachelor of Science in Industrial Engineering and Management, 0 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
555211A  Maturity Test / Industrial Engineering and Management  0.0 op

**Assessment methods and criteria:**
Maturity test related to the thesis topic is taken as an electronic exam in the Exam-system. Examination time is settled with the thesis supervisor. The assessor of the maturity test (supervisor) creates the maturity into the Exam system as a personal exam.

**Grading:**
Pass-Fail.

**Person responsible:**
University lecturer Osmo Kauppila

**Other information:**
The general instructions related to thesis, matury test and graduation are available at the Oulu University's webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.

**555307M: Common Studies of the Majors in other Universities /Institutes, 0 - 30 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish

**Person responsible:**
University lecturer Osmo Kauppila
A440230: Major Studies, Product Management, 40 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

555313S: Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannele Lampela
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of general management
- know the historical developments in the management thought
- have an understanding about the qualifications of a manager in a modern organisation
- understand the principles of the managerial decision making
- distinguish between the terms management and leadership
- have an understanding about good managerial practices

Contents:

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures and case examples from visiting lecturers 20 h, self-study 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.
Recommended optional programme components:

- 

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on an exam (course book) or on a learning diary (critical lecture notes).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Hannele Lampela

Working life cooperation:
The course includes guest lectures by industry representatives to offer various and topical views to management practice in different types of organizations.

Other information:

555314S: Management Information Systems, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannele Lampela
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the key concepts of management information systems
- understand the significance of information and information management in modern business and business process management
- define the information needs of management processes and understands how information systems can meet these needs
- recognise the current trends in management information systems technologies and practices and find out the relevant MIS information sources
- participate in enterprise information system designing, purchasing, and development tasks in a role of an industrial engineer/process developer
- strengthen the self-directing, reflective learning skills

Contents:
Key concepts: management information systems (MIS), managerial information, different types of MIS applications, information systems in decision making and leadership, the effects of information technology in business processes and their development. Current trends in management information systems technologies and practices, business driven IT infrastructure and management, special characteristics of business development projects that contain ICT implementation.

Mode of delivery:
The tuition will be implemented as online teaching.
Learning activities and teaching methods:
Self-study and group work 135 h supported by online meetings. The implementation methods of the self-study and group work vary.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent, 555313S Management.

Recommended optional programme components:
Basic understanding of some business process areas helps learning (e.g. production management, supply chain management, sales and marketing management).

Recommended or required reading:
Course materials will be defined at the beginning of the course in Moodle.

Assessment methods and criteria:
This course utilises continuous assessment based on conducting the learning tasks (individual and group work). Since the implementation of self-study and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Hannele Lampela

Working life cooperation:
The course includes the guest lectures of industry to offer various and topical views to MIS in practice.

Other information:
Substitutes the course 555344S Management Information Systems.

555301S: Research Seminar, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannele Lampela
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Teaching during periods 1 - 4. Course can be completed in parts. Course registration is open during 15.8. - 15.5.

Learning outcomes:
Upon completion of the course, the student will be able to:
- know scientific process and different research methods
- select an appropriate method for his/her master’s thesis work
- evaluate validity of research work and provide constructive criticism
- report research findings in the form of academic research report and participate in academic discussion

Contents:
Research approach, qualitative and quantitative research methods, structure of research report, evaluating validity of research, constructive criticism and participation in scientific discussion.

**Mode of delivery:**
Multiform learning, with face-to-face lectures, seminar work and independent learning. The course will use Moodle platform.

**Learning activities and teaching methods:**
Lectures and seminar work 20 h, independent learning 114 h.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
Research report is based on research work student is doing for his/her master’s thesis work

**Recommended or required reading:**
Lecture material. Other materials will be defined at the beginning of the course.

**Assessment methods and criteria:**
The course can be completed in seminar sessions by actively participating in discussion, presenting own research work, giving feedback on other student’s research work, acting as an opponent to two ready thesis works, and writing a scientific article on own research topic. The seminar sessions will include three lectures on research approach and qualitative and quantitative research methods, and writing a scientific article. Participation in these three lectures is required to pass the course and they are lectured two times a year.

**Grading:**
The course utilizes verbal grading “Pass/Fail”.

**Person responsible:**
D. Sc. Hannele Lampela

**Working life cooperation:**
No.

**Other information:**
The general instructions related to thesis, matury test and graduation are available at the Oulu University's webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.

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555304S: Advanced Internship, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Practical training
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**

- 555311S  Advanced Internship  3.0 op

**ECTS Credits:**
5 ECTS cr

**Language of instruction:**
English

**Timing:**
Periods 1 - 4 and summer
Learning outcomes:
Upon completion of the course, the student will be able to:
- apply the skills required for the tasks in the working life (communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills)
- take responsibility for the tasks in a responsible manner
- reflect the tasks to IEM studies completed
- analyse and find development targets in IEM courses related to the tasks

Contents:
Communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills

Mode of delivery:
The tuition will not be organised. The student is responsible for finding the internship position that can be a summer job, some other salaried position or work experience, or a position without salary in an organization.

Learning activities and teaching methods:
Students complete tasks with their own activities to support their own professional growth in working-life. Internship duration should be at least 2 months.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
Bachelor's degree or equivalent knowledge.

Recommended optional programme components:
-

Recommended or required reading:
-

Assessment methods and criteria:
The internship must provide at least 2 months working experience related to your studies. Internship period cannot be the same as in course 555204A Harjoittelu. The length of the written report is 2-3 pages and it must address the following questions:
- Where (organization name, location) did you perform the internship?
- How did you find this position (PESTI-days or some other way)?
- How was the application procedure? Was there an interview etc?
- Have you worked in this organization earlier?
- What tasks were you doing during the internship period?
- Were these tasks related to your major, supplementary, or engineering studies?
- Which theories or skills in IEM courses were useful in your job?
- What type of topics should be added to the IEM courses based on your internship experience?

The report and a certificate provided by the organization where internship took place must be sent via email to your teacher tutor (Product Management (https://www.oulu.fi/forstudents/tutor-teaching#6503), Tuotantotalouden tutkinto- ja maisteriohjelmat (https://www.oulu.fi/opiskelijalle/omaopettaja#6503)).

Grading:
Pass/ Fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
Yes. The student gains working experience in an organization.

Other information:
Information about internship placements and financial support can be found in Oulu University’s webpage about traineeship. On traineeship issues you can contact the traineeship contact person for Faculty of Technology

Substitutes the course 555311S Advanced Internship.
555350S: Research and Technology Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
   555340S Technology Management  4.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the differences between product development and technology management in a company
- piece together the development needs and cycles of technologies in an organisation
- combine technology development and technology management with strategic planning of a company

Contents:
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquisition, and transition

Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:

Recommended or required reading:
Lecture materials and articles.

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry

Other information:
Previous course name was 'Technology Management'.
Substitutes course 555340S Technology Management.
555351S: Advanced Course in Product Development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English

Leikkaavuudet:

555345S  Advanced Course in Product Development  6.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the objectives of requirements engineering (RE), design for excellence (DfX) product design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable products with minimum product specific investments
- understand requirements engineering process and its key activities, DfX product design concept as product design guidelines, targets and key performance indicators (KPIs)
- understand DCC process as a sub-process of new product development (NPD) process including key roles, tasks and milestone criteria
- analyse and further develop RM, DfX and DCC as a part of product development processes

Contents:
The concepts of requirements management, requirements engineering process, requirement prioritisation and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and their requirements for product development

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 16 h / group work and self-study 119 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Research and Technology management (Technology Management).

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Group work, exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo
Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Substitutes course 555345S Advanced Course in Product Development.

555343S: Product Data and product life cycle management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.
Language of instruction:
English.
Timing:
Period 3-4.

Learning outcomes:
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:
- understand the basic terminology related to product, productisation, PDM and PLM
- analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies
- create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data
- model the company’s HW, SW and Service product related commercial and technical product portfolios according to productisation concept
- understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept
- create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

Contents:
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

Mode of delivery:
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242 Product development

Recommended optional programme components:
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

**Recommended or required reading:**
Lecture materials and selected articles.

**Assessment methods and criteria:**
Group work report (50 % of the grade) and exam (50 % of the grade).

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Erno Mustonen

**Working life cooperation:**
The group work will be done in cooperation with case companies.

**Other information:**
Previous course name was 'Product Data Management'.

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**555346S: Product portfolio management, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Erno Mustonen

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

**Required proficiency level:**

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Periods 3-4.

**Learning outcomes:**
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

**Contents:**
Basic issues in product and product portfolio management performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

**Mode of delivery:**
The tuition will be implemented as face-to-face learning and practical assignments.
Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Technology management.

Recommended optional programme components:

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
No.

Other information:
Previous course name was ‘Product Management’

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

Person responsible:
Yliopistonlehtori Osmo Kauppila

A440259: Complementary Study Module of the Major/ Organization and Knowledge management, Advanced Module, 10 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.
555370S: Strategic Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
- utilise strategic thinking, planning, and management
- analyse and plan complex global business operations
- participate in strategic planning and strategy implementation in organisations
- apply strategy analysis frameworks and analyse the implementation of the chosen strategy

Contents:
Strategic thinking, strategic planning, strategic management, strategy analysis frameworks, strategy implementation with a simulation, analysis of the strategy implementation.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 12 h (lectures 6 h, exercises 6 h), group work 122 h. Alternatively independent learning method: book examination 134 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. The group work includes the creation of strategic plan (10 % of the grade), business simulation (30 % of the grade), and the analysis of the strategy (60 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava
Working life cooperation:
-

Other information:
Substitutes course 555320S Strategic Management.

555371S: Human Resource Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: English
Leikkaavuudet:

555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of human resource management
- utilise methods in analysing and planning of human resource practices in organisations
- participate in human resource practices planning and implementation in organisations
- apply PCMM (People Capability Maturity Model) frameworks
- know the basic Finnish laws, bylaws and trade agreements in the area of human resource management

Contents:

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures 10 h, assignment guidance 10 h), group work 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Arto Reiman

Working life cooperation:
The group work is done in cooperation with case companies.

Elective advanced studies

555377S: Risk Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:

555321S Risk Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the key concepts of enterprise risk management and uncertainty management
- explain the role of risk management in organisations and compare the specific features of risk management in different organisational contexts
- identify and classify risks and conduct systematic risk analyses in organisations
- make informed improvement suggestions related to enterprise risk management in organisations
- to develop enterprise risk management processes in organisations

Contents:
Definitions of risk and uncertainty, risk management standards, risk classification models, sys-tematic risk management process, methods of risk management, psychological aspects of risk management, ERM and organising of risk management, risk management in different contexts, risk governance.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 26 h (lectures 26h), self-study 42h, group assignment and cases 66 h.
Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture. The materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant Professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555321S Risk Management.

555378S: Seminar in industrial engineering and management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555385S Advanced Course in Quality Management  5.0 op
  555386S Advanced Course in Project Management  5.0 op
  555347S Seminar in Technology Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English.

Timing:
Periods 1-4.

Learning outcomes:
Learning outcomes depend on the content of each seminar. The seminar topics are related to production management, product management, organization and knowledge management, project management, and process and quality management.
Contents:
Will be defined at the beginning of the course.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:

555379S: Research Project in Industrial Engineering and Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555367S Exercises in Work Science 6.0 op
  555387S Project Work in Quality Management 5.0 op
  555388S Project Work in Project Management 5.0 op
  555326S Research Project in Production Management 5.0 op
  555348S Research Project in Technology Management 5.0 op
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English

Timing:
Periods 1-4 or as summer studies independently
Learning outcomes:
Learning outcomes depend on the project work contents.

Contents:
Project work topics and types vary. The topics are typically related to actual problems in the industry.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
The methods are agreed with the project work instructor. The work can be done individually or in a group.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
The assessment is based on the project work report.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:

Other information:
The objective of the course is to apply the methods of industrial engineering and management in a company’s development activities. The course provides the student with an opportunity to combine and apply his/her existing knowledge in a study project. The student familiarises himself/herself with research work and reporting of the results.


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**Project Management**

555391S: Advanced Course in Project Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>555381S</td>
<td>Project Leadership</td>
<td>5.0 op</td>
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ECTS Credits:
5 ECTS credits.
Language of instruction:
English.

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain and describe the most important project management areas and tools
- identify and evaluate the most applicable managerial approaches for different types of projects
- identify development needs and opportunities in project-based organisations
- to develop project management processes in an organisation

Contents:
different type of projects and industry specific approaches to project management, agile project management, managing large international projects, project governance, project risk and uncertainty management, project time and schedule management, management of innovative projects.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures, web-based-lectures and workshops 26h, group exercises and cases 66h, self-study 42h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555285A Basic course in project management.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555381S Project Leadership.

555382S: Management of a project-based firm, 5 op
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jaakko Kujala
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course student will be able to:
- describe the core areas of the management of the project-based firm
- explain how different internal and external contextual factors affect the business of a project-based firm, and how they should be taken account in the design of a business model
- understand the role of services in the business of a project-based firm
- apply systematic approach to project negotiation
- evaluate the significance of a single project for the business of a project based-firm

Contents:
Contextual factors in project business, business model of a project-based firm, integration of services to the business of a project-based firm, project sales and marketing, contracting, project negotiations (negotiation analytic approach) and organising support functions in project-based firm.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 24h / self-study 56h / group exercise 54h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Lecture materials. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
The course utilises continuous assessment. During the course, the students must write a learning diary for each lecture and participate actively in the lectures. 40% of the grade is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Jaakko Kujala

Working life cooperation:
Group work will be done for a project-based firm or public sector organisation.

Other information:
Timing in academic year 2021-22 is 3rd period.
Process and Quality Management

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555380S  Quality Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Contents:
Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
28 h lectures, 106 h independent study on course exercises.

Target group:
Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555286A Process and Quality Management

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS credits.

Language of instruction:
Finnish

Timing:
Periods 1 - 2

Learning outcomes:
Upon completion of the course, the student will be able to:

- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:
Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:
The tuition will be implemented as blended teaching.

Learning activities and teaching methods:
Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:
Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:
Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
a group exercise related to a process operating in practice.

Other information:

Product Management

555350S: Research and Technology Management, 5 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
  555340S  Technology Management  4.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the differences between product development and technology management in a company
- piece together the development needs and cycles of technologies in an organisation
- combine technology development and technology management with strategic planning of a company

Contents:
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquirement, and transition

Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and articles.

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry

Other information:
Previous course name was 'Technology Management'. Substitutes course 555340S Technology Management.

555351S: Advanced Course in Product Development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:

  555345S Advanced Course in Product Development 6.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:

• understand the objectives of requirements engineering (RE), design for excellence (DfX) product design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable products with minimum product specific investments
• understand requirements engineering process and its key activities, DfX product design concept as product design guidelines, targets and key performance indicators (KPIs)
• understand DCC process as a sub-process of new product development (NPD) process including key roles, tasks and milestone criteria
• analyse and further develop RM, DfX and DCC as a part of product development processes

Contents:
The concepts of requirements management, requirements engineering process, requirement prioritisation and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and their requirements for product development

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 16 h / group work and self-study 119 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Research and Technology management (Technology Management).

**Recommended optional programme components:**
- 

**Recommended or required reading:**
Will be defined at the beginning of the course.

**Assessment methods and criteria:**
Group work, exam.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Professor Harri Haapasalo

**Working life cooperation:**
The group work will be done in cooperation with case companies.

**Other information:**
Substitutes course 555345S Advanced Course in Product Development.

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**555343S: Product Data and product life cycle management, 5 op**

**Opiskelumuoto:** Advanced Studies  
**Laji:** Course  
**Vastuuysikkö:** Field of Industrial Engineering and Management  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Erno Mustonen  
**Opintokohteen kielet:** English  
**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Period 3-4.

**Learning outcomes:**
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:
- understand the basic terminology related to product, productisation, PDM and PLM  
- analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies  
- create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data  
- model the company’s HW, SW and Service product related commercial and technical product portfolios according to productisation concept  
- understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept  
- create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

**Contents:**
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

**Learning activities and teaching methods:**
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
555242 Product development

**Recommended optional programme components:**
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

**Recommended or required reading:**
Lecture materials and selected articles.

**Assessment methods and criteria:**
Group work report (50 % of the grade) and exam (50 % of the grade).

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Erno Mustonen

**Working life cooperation:**
The group work will be done in cooperation with case companies.

**Other information:**
Previous course name was 'Product Data Management'.

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**555346S: Product portfolio management, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Erno Mustonen

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

**Required proficiency level:**

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Periods 3-4.

**Learning outcomes:**
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

**Contents:**
Basic issues in product and product portfolio management performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

**Mode of delivery:**
The tuition will be implemented as face-to-face learning and practical assignments.

**Learning activities and teaching methods:**
Will be defined at the beginning of the course.

**Target group:**
Industrial Engineering and Management and Master’s Programme in Product Management students.

**Prerequisites and co-requisites:**
555242A Product development, 555350S Technology management.

**Recommended optional programme components:**
-

**Recommended or required reading:**
Will be defined at the beginning of the course.

**Assessment methods and criteria:**
Will be defined at the beginning of the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Erno Mustonen

**Working life cooperation:**
No.

**Other information:**
Previous course name was ‘Product Management’

*Production Management*

**555330S: Sourcing Management, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskeluumo:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Jukka Majava
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**
ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.

Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.

Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 hrs (lectures/ assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

Target group:
Industrial Engineering Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture notes. Other material will be defined at the beginning of the course

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555323S Sourcing Management.

555331S: Advanced Supply Chain Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikko: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava  
Opintokohteen kielet: Finnish  
Leikkaavuudet:  
555324S Advanced Supply Chain Management 3.0 op

ECTS Credits:  
5 ECTS credits.

Language of instruction:  
Finnish. English material is also used.

Timing:  
Periods 3-4.

Learning outcomes:  
Upon completion of the course, the student will be able to:  
- describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management  
- develop and analyse supply networks and create development proposals to improve productivity and competitiveness  
- understand the importance of risk management in supply networks  
- know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

Contents:  
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

Mode of delivery:  
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:  
Face-to-face teaching 16 h (lectures/group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

Target group:  
Industrial Engineering and Management students.

Prerequisites and co-requisites:  
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:  
-

Recommended or required reading:  
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course

Assessment methods and criteria:  
The grade will be based on the group work (60 % of the grade) and book examination (40 % of the grade).

Grading:  
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:  
Associate professor Jukka Majava

Working life cooperation:  
Case organisations’ supply chain related data is utilised in the group works.

Other information:  
-
**555332S: Operations and supply network analytics, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

555342S  Operations Research  5.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English

**Timing:**
Period 4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

**Contents:**
What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).

**Learning activities and teaching methods:**
Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

**Target group:**
Industrial engineering and management students.

**Prerequisites and co-requisites:**
Bachelor in industrial engineering and management or equivalent.

**Recommended or required reading:**

**Assessment methods and criteria:**
To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50%).

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University lecturer Osmo Kauppila

**Working life cooperation:**
No.
Other information:
Substitutes course 555342S Operations Research.

555333S: Production Management, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Jukka Majava
**Opintokohteen kielet:** English

Leikkaavuudet:
555322S Production Management 3.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English

**Timing:**
Periods 1-2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production

**Contents:**
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

**Mode of delivery:**
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

**Learning activities and teaching methods:**
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108 hrs.

**Target group:**
Industrial Engineering and Management and Master’s Programme in Product Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
-

**Recommended or required reading:**

**Assessment methods and criteria:**
The assessment is based on the group work.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

Person responsible:
Yliopistonlehtori Osmo Kauppila

A440260: Complementary Study Module of the Major/ Project Management, Advanced Module, 10 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory studies of Project Management

555391S: Advanced Course in Project Management, 5 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:

555381S Project Leadership 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.
Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course, the student will be able to:

- explain and describe the most important project management areas and tools
- identify and evaluate the most applicable managerial approaches for different types of projects
- identify development needs and opportunities in project-based organisations
- to develop project management processes in an organisation

Contents:

different type of projects and industry specific approaches to project management, agile project management, managing large international projects, project governance, project risk and uncertainty management, project time and schedule management, management of innovative projects.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Lectures, web-based-lectures and workshops 26h, group exercises and cases 66h, self-study 42h.

Target group:

Industrial Engineering and Management students.

Prerequisites and co-requisites:

555285A Basic course in project management.

Recommended optional programme components:

- 

Recommended or required reading:

Lecture materials and reading materials (articles, book chapters) related to each lecture.

Assessment methods and criteria:

This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Assistant professor Kirsi Aaltonen

Working life cooperation:

The course includes guest lectures from industry.

Other information:

Substitutes course 555381S Project Leadership.
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jaakko Kujala
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course student will be able to:
- describe the core areas of the management of the project-based firm
- explain how different internal and external contextual factors affect the business of a project-based firm, and how they should be taken account in the design of a business model
- understand the role of services in the business of a project-based firm
- apply systematic approach to project negotiation
- evaluate the significance of a single project for the business of a project based-firm

Contents:
Contextual factors in project business, business model of a project-based firm, integration of services to the business of a project-based firm, project sales and marketing, contracting, project negotiations (negotiation analytic approach) and organising support functions in project-based firm.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 24h / self-study56h / group exercise 54h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended or required reading:
Lecture materials. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
The course utilises continuous assessment. During the course, the students must write a learning diary for each lecture and participate actively in the lectures. 40% of the grade is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Jaakko Kujala

Working life cooperation:
Group work will be done for a project-based firm or public sector organisation.

Other information:
Timing in academic year 2021-22 is 3rd period.
Selective advanced studies

555376S: Sustainable organisational development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1-5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: Finnish
Leikkaavuudet:

555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used (the course can be completed in English by the group work and examination).

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the general models regarding sustainable organisational development
- adapt the most central ones to the work organisations
- choose the most suitable models for different situations and can interpret the results gained from different approaches
- explain the most important quantitative and qualitative variables that are either preconditions or results of the operation of the organisation
- identify development needs and opportunities in companies and other organisations.

Contents:
The development of organisation is examined through e.g. the following concepts: productivity, well-being at work, quality control, quality of working life, safety and security, and responsibility. Various concepts and indicators will be discussed, for example, in relation with change processes (e.g. strategy, owner, partnerships, sizes of operations and personnel), implementation, participation, intervention, action research, and learning organisation.

Mode of delivery:
The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:
Face-to-face teaching 18 h (lectures 18 h, exercises and group work 16 h), self-study 100 h.

Target group:
Industrial Engineering and Management students.
Prerequisites and co-requisites:
555265P Occupational safety and health management, 555264P Managing well-being and quality of working life, 555371S Human resource management.

Recommended optional programme components:
555371S Human resource management, 555370S Strategic management, 555377S Risk Management. Research project in industrial engineering and management related to Organisation and knowledge management topic and Faculty of Education’s Organisational psychology course can be conducted to complement this course.

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment including exercises during the lectures (weight 20 %), group work (weight 50 %) and examination (weight 30 %).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Arto Reiman

Working life cooperation:
-

Other information:
Previous course name was Organisational Development. Substitutes course 555360S Administration, Organization and Education in Working Life.

555377S: Risk Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:
555321S Risk Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:

- explain the key concepts of enterprise risk management and uncertainty management
- explain the role of risk management in organisations and compare the specific features of risk management in different organisational contexts
- identify and classify risks and conduct systematic risk analyses in organisations
- make informed improvement suggestions related to enterprise risk management in organisations
- to develop enterprise risk management processes in organisations

Contents:
Definitions of risk and uncertainty, risk management standards, risk classification models, systematic risk management process, methods of risk management, psychological aspects of risk management, ERM and organising of risk management, risk management in different contexts, risk governance.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 26 h (lectures 26h), self-study 42h, group assignment and cases 66 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
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Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture. The materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant Professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555321S Risk Management.

555378S: Seminar in industrial engineering and management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettaja: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
555385S Advanced Course in Quality Management  5.0 op
555386S Advanced Course in Project Management  5.0 op
555347S Seminar in Technology Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English.

Timing:
Periods 1-4.

Learning outcomes:
Learning outcomes depend on the content of each seminar. The seminar topics are related to production management, product management, organization and knowledge management, project management, and process and quality management.

Contents:
Will be defined at the beginning of the course.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:

555379S: Research Project in Industrial Engineering and Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
555367S Exercises in Work Science  6.0 op
555387S Project Work in Quality Management  5.0 op
555388S Project Work in Project Management  5.0 op
555326S Research Project in Production Management  5.0 op
555348S Research Project in Technology Management  5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English

Timing:
Periods 1-4 or as summer studies independently

Learning outcomes:
Learning outcomes depend on the project work contents.

Contents:
Project work topics and types vary. The topics are typically related to actual problems in the industry.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
The methods are agreed with the project work instructor. The work can be done individually or in a group.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
The assessment is based on the project work report.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
The objective of the course is to apply the methods of industrial engineering and management in a company’s development activities. The course provides the student with an opportunity to combine and apply his/her existing knowledge in a study project. The student familiarises himself/herself with research work and reporting of the results.

Organisation and knowledge management
555370S: Strategic Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:

      555320S  Strategic Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
- utilise strategic thinking, planning, and management
- analyse and plan complex global business operations
- participate in strategic planning and strategy implementation in organisations
- apply strategy analysis frameworks and analyse the implementation of the chosen strategy

Contents:
Strategic thinking, strategic planning, strategic management, strategy analysis frameworks, strategy implementation with a simulation, analysis of the strategy implementation.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 12 h (lectures 6 h, exercises 6 h), group work 122 h. Alternatively independent learning method: book examination 134 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

-  

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. The group work includes the creation of strategic plan (10 % of the grade), business simulation (30 % of the grade), and the analysis of the strategy (60 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:

-
Other information:
Substitutes course 555320S Strategic Management.

555371S: Human Resource Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: English
Leikkaavuudet:
555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of human resource management
- utilise methods in analysing and planning of human resource practices in organisations
- participate in human resource practices planning and implementation in organisations
- apply PCMM (People Capability Maturity Model) frameworks
- know the basic Finnish laws, bylaws and trade agreements in the area of human resource management

Contents:

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures 10 h, assignment guidance 10 h), group work 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Arto Reiman

Working life cooperation:
The group work is done in cooperation with case companies.

Process and Quality Management

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555380S  Quality Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Contents:
Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
28 h lectures, 106 h independent study on course exercises.

Target group:
Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555286A Process and Quality Management
Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS credits.

Language of instruction:
Finnish

Timing:
Periods 1 - 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:
Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:
The tuition will be implemented as blended teaching.

Learning activities and teaching methods:
Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:
Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

**Prerequisites and co-requisites:**
Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

**Recommended optional programme components:**

**Recommended or required reading:**

**Assessment methods and criteria:**
To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University lecturer Osmo Kauppila.

**Working life cooperation:**
a group exercise related to a process operating in practice.

**Other information:**

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**Product Management**

555350S: Research and Technology Management, 5 op

*Voimassaolo:* 01.08.2015 -
*Opiskelumuoto:* Advanced Studies
*Laji:* Course
*Vastuuysikkö:* Field of Industrial Engineering and Management
*Arvostelu:* 1 - 5, pass, fail
*Opettajat:* Haapasalo, Harri Jouni Olavi
*Opintokohteen kielet:* English
*Leikkaavuudet:*

555340S  Technology Management  4.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Period 2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- understand the differences between product development and technology management in a company
- piece together the development needs and cycles of technologies in an organisation
- combine technology development and technology management with strategic planning of a company

**Contents:**
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquisition, and transition...
Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and articles.

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry

Other information:
Previous course name was 'Technology Management'.
Substitutes course 555340S Technology Management.

555351S: Advanced Course in Product Development, 5 op

Voimassaolo: 01.08.2015 - 
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
555345S Advanced Course in Product Development 6.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the objectives of requirements engineering (RE), design for excellence (DfX) product design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable products with minimum product specific investments
- understand requirements engineering process and its key activities, DfX product design concept as product design guidelines, targets and key performance indicators (KPIs)
- understand DCC process as a sub-process of new product development (NPD) process including key roles, tasks and milestone criteria
analyse and further develop RM, DfX and DCC as a part of product development processes

Contents:
The concepts of requirements management, requirements engineering process, requirement prioritisation and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and their requirements for product development

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 16 h / group work and self-study 119 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Research and Technology management (Technology Management).

Recommended optional programme components:

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Group work, exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Substitutes course 555345S Advanced Course in Product Development.

555343S: Product Data and product life cycle management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3-4.

Learning outcomes:
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:

- understand the basic terminology related to product, productisation, PDM and PLM
• analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies
• create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data
• model the company’s HW, SW and Service product related commercial and technical product portfolios according to productisation concept
• understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept
• create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

Contents:
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

Mode of delivery:
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242 Product development

Recommended optional programme components:
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

Recommended or required reading:
Lecture materials and selected articles.

Assessment methods and criteria:
Group work report (50 % of the grade) and exam (50 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Previous course name was ‘Product Data Management’.

555346S: Product portfolio management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opiyhteen kielet: English
Voidaan suorittaa useasti: Kyllä

Required proficiency level:
ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 3-4.

Learning outcomes:
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

Contents:
Basic issues in product and product portfolio management performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

Mode of delivery:
The tuition will be implemented as face-to-face learning and practical assignments.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Technology management.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
No.

Other information:
Previous course name was ‘Product Management’
555330S: Sourcing Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.

Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.

Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 hrs (lectures/ assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

Target group:
Industrial Engineering Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture notes. Other material will be defined at the beginning of the course

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava
Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555323S Sourcing Management.

555331S: Advanced Supply Chain Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:

555324S Advanced Supply Chain Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used.

Timing:
Periods 3-4.

Learning outcomes:
Upon completion of the course, the student will be able to:

- describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management
- develop and analyse supply networks and create development proposals to improve productivity and competitiveness
- understand the importance of risk management in supply networks
- know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

Contents:
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 16 h (lectures/ group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course
Assessment methods and criteria:
The grade will be based on the group work (60 % of the grade) and book examination (40 % of the grade).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Associate professor Jukka Majava

Working life cooperation:
Case organisations’ supply chain related data is utilised in the group works.

Other information:

555332S: Operations and supply network analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555342S Operations Research 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

Contents:
What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).

Learning activities and teaching methods:
Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

Target group:
Industrial engineering and management students.

Prerequisites and co-requisites:
Bachelor in industrial engineering and management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50%).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
No.

Other information:
Substitutes course 555342S Operations Research.

555333S: Production Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:

555322S Production Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production

Contents:
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108 hrs.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.
Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

Person responsible:
Yliopistonlehtori Osmo Kauppila

A440261: Complementary Study Module of the Major/ Process and Quality Management, Advanced Module, 15 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory studies of Process and Quality Management

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555380S Quality Management 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
• analyse and improve the processes of an organisation with the help of statistical tools
• disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Contents:
Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
28 h lectures, 106 h independent study on course exercises.

Target group:
Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555286A Process and Quality Management

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555380S Quality Management.
555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS credits.

Language of instruction:
Finnish

Timing:
Periods 1 - 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:
Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:
The tuition will be implemented as blended teaching.

Learning activities and teaching methods:
Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:
Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:
Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
a group exercise related to a process operating in practice.
Other information:

Elective advanced studies

555376S: Sustainable organisational development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: Finnish
Leikkaavuudet: 555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used (the course can be completed in English by the group work and examination).

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the general models regarding sustainable organisational development
- adapt the most central ones to the work organisations
- choose the most suitable models for different situations and can interpret the results gained from different approaches
- explain the most important quantitative and qualitative variables that are either preconditions or results of the operation of the organisation
- identify development needs and opportunities in companies and other organisations.

Contents:
The development of organisation is examined through e.g. the following concepts: productivity, well-being at work, quality control, quality of working life, safety and security, and responsibility. Various concepts and indicators will be discussed, for example, in relation with change processes (e.g. strategy, owner, partnerships, sizes of operations and personnel), implementation, participation, intervention, action research, and learning organisation.

Mode of delivery:
The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:
Face-to-face teaching 18 h (lectures 18 h, exercises and group work 16 h), self-study 100 h).

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555265P Occupational safety and health management, 555264P Managing well-being and quality of working life, 555371S Human resource management.

Recommended optional programme components:
555371S Human resource management, 555370S Strategic management, 555377S Risk Management. Research project in industrial engineering and management related to Organisation and knowledge management topic and Faculty of Education’s Organisational psychology course can be conducted to complement this course.

**Recommended or required reading:**

**Assessment methods and criteria:**
This course utilises continuous assessment including exercises during the lectures (weight 20 %), group work (weight 50 %) and examination (weight 30 %).

**Grading:**
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Arto Reiman

**Working life cooperation:**
-

**Other information:**
Previous course name was Organisational Development. Substitutes course 555360S Administration, Organization and Education in Working Life.

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**555377S: Risk Management, 5 op**

**Voimassaolo:** 01.08.2015 -  
**Opiskelumuoto:** Advanced Studies  
**Laji:** Course  
**Vastuuysikkö:** Field of Industrial Engineering and Management  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Kirsi Aaltonen  
**Opintokohteen kielet:** English  
**Leikkaavuudet:**  

| 555321S | Risk Management | 3.0 op |

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English

**Timing:**
Period 2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- explain the key concepts of enterprise risk management and uncertainty management
- explain the role of risk management in organisations and compare the specific features of risk management in different organisational contexts
- identify and classify risks and conduct systematic risk analyses in organisations
- make informed improvement suggestions related to enterprise risk management in organisations
- to develop enterprise risk management processes in organisations
Contents:
Definitions of risk and uncertainty, risk management standards, systemic risk management process, methods of risk management, psychological aspects of risk management, ERM and organising of risk management, risk management in different contexts, risk governance.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 26 h (lectures 26h), self-study 42h, group assignment and cases 66 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture. The materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant Professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555321S Risk Management.

555378S: Seminar in industrial engineering and management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppinen
Opintokohteen kielet: Finnish
Leikkaavuudet:
555385S Advanced Course in Quality Management 5.0 op
555386S Advanced Course in Project Management 5.0 op
555347S Seminar in Technology Management 5.0 op
ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English.

Timing:
Periods 1-4.

Learning outcomes:
Learning outcomes depend on the content of each seminar. The seminar topics are related to production management, product management, organization and knowledge management, project management, and process and quality management.

Contents:
Will be defined at the beginning of the course.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
555326S  Research Project in Production Management  5.0 op
555348S  Research Project in Technology Management  5.0 op

Voidaan suorittaa useasti: Kyllä

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish/English

**Timing:**
Periods 1-4 or as summer studies independently

**Learning outcomes:**
Learning outcomes depend on the project work contents.

**Contents:**
Project work topics and types vary. The topics are typically related to actual problems in the industry.

**Mode of delivery:**
Will be defined at the beginning of the course.

**Learning activities and teaching methods:**
The methods are agreed with the project work instructor. The work can be done individually or in a group.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**

**Recommended or required reading:**
Will be defined at the beginning of the course.

**Assessment methods and criteria:**
The assessment is based on the project work report.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

**Person responsible:**
University lecturer Osmo Kauppila

**Working life cooperation:**

**Other information:**
The objective of the course is to apply the methods of industrial engineering and management in a company’s development activities. The course provides the student with an opportunity to combine and apply his/her existing knowledge in a study project. The student familiarises himself/herself with research work and reporting of the results.


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**Project Management**

555391S: Advanced Course in Project Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:

555381S Project Leadership 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain and describe the most important project management areas and tools
- identify and evaluate the most applicable managerial approaches for different types of projects
- identify development needs and opportunities in project-based organisations
- to develop project management processes in an organisation

Contents:
different type of projects and industry specific approaches to project management, agile project management, managing large international projects, project governance, project risk and uncertainty management, project time and schedule management, management of innovative projects.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures, web-based-lectures and workshops 26h, group exercises and cases 66h, self-study 42h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555285A Basic course in project management.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555381S Project Leadership.

555382S: Management of a project-based firm, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jaakko Kujala
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course student will be able to:
- describe the core areas of the management of the project-based firm
- explain how different internal and external contextual factors affect the business of a project-based firm, and how they should be taken account in the design of a business model
- understand the role of services in the business of a project-based firm
- apply systematic approach to project negotiation
- evaluate the significance of a single project for the business of a project-based firm

Contents:
Contextual factors in project business, business model of a project-based firm, integration of services to the business of a project-based firm, project sales and marketing, contracting, project negotiations (negotiation analytic approach) and organising support functions in project-based firm.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 24h / self-study 56h / group exercise 54h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Lecture materials. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
The course utilises continuous assessment. During the course, the students must write a learning diary for each lecture and participate actively in the lectures. 40% of the grade is based on the group work.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Professor Jaakko Kujala

**Working life cooperation:**
Group work will be done for a project-based firm or public sector organisation.

**Other information:**
Timing in academic year 2021-22 is 3rd period.

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**Organisation and knowledge management**

**555370S: Strategic Management, 5 op**

- **Voimassaolo:** 01.08.2015 -
- **Opiskelumuoto:** Advanced Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Jukka Majava
- **Opintokohteen kielet:** English

**Leikkaavuudet:**

- 555320S Strategic Management 5.0 op

**ECTS Credits:**

5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Period 3.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- utilise strategic thinking, planning, and management
- analyse and plan complex global business operations
- participate in strategic planning and strategy implementation in organisations
- apply strategy analysis frameworks and analyse the implementation of the chosen strategy

**Contents:**
Strategic thinking, strategic planning, strategic management, strategy analysis frameworks, strategy implementation with a simulation, analysis of the strategy implementation.

**Mode of delivery:**
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

**Learning activities and teaching methods:**
Face-to-face teaching 12 h (lectures 6 h, exercises 6 h), group work 122 h. Alternatively independent learning method: book examination 134 h.

**Target group:**
Industrial Engineering and Management.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
-
Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. The group work includes the creation of strategic plan (10 % of the grade), business simulation (30 % of the grade), and the analysis of the strategy (60 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
-

Other information:
Substitutes course 555320S Strategic Management.

555371S: Human Resource Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: English
Leikkaavuudet:
   555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of human resource management
- utilise methods in analysing and planning of human resource practices in organisations
- participate in human resource practices planning and implementation in organisations
- apply PCMM (People Capability Maturity Model) frameworks
- know the basic Finnish laws, bylaws and trade agreements in the area of human resource management

Contents:

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).
Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures 10 h, assignment guidance 10 h), group work 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Arto Reiman

Working life cooperation:
The group work is done in cooperation with case companies.

Production Management

555330S: Sourcing Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:

555323S Sourcing Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.

Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.
Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 hrs (lectures/assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

Target group:
Industrial Engineering Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture notes. Other material will be defined at the beginning of the course

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555323S Sourcing Management.

555331S: Advanced Supply Chain Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:

555324S Advanced Supply Chain Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used.

Timing:
Periods 3-4.

Learning outcomes:
Upon completion of the course, the student will be able to:
• describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management
• develop and analyse supply networks and create development proposals to improve productivity and competitiveness
• understand the importance of risk management in supply networks
• know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

Contents:
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 16 h (lectures/ group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course

Assessment methods and criteria:
The grade will be based on the group work (60 % of the grade) and book examination (40 % of the grade).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Associate professor Jukka Majava

Working life cooperation:
Case organisations’ supply chain related data is utilised in the group works.

Other information:

555332S: Operations and supply network analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppiä
Opintokohteen kielet: Finnish
Leikkaavuudet:

555342S Operations Research 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

Contents:
What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).

Learning activities and teaching methods:
Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

Target group:
Industrial engineering and management students.

Prerequisites and co-requisites:
Bachelor in industrial engineering and management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50%).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
No.

Other information:
Substitutes course 555342S Operations Research.
ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production

Contents:
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108 hrs.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.

Product Management

555350S: Research and Technology Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:

555340S Technology Management 4.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
  - understand the differences between product development and technology management in a company
  - piece together the development needs and cycles of technologies in an organisation
  - combine technology development and technology management with strategic planning of a company

Contents:
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquirement, and transition

Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:
- 

Recommended or required reading:
Lecture materials and articles.

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry

Other information:
Previous course name was 'Technology Management'. Substitutes course 555340S Technology Management.

555351S: Advanced Course in Product Development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
**Vastuuysikkö:** Field of Industrial Engineering and Management  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Haapasalo, Harri Jouni Olavi  
**Opintokohteen kielet:** English

**Leikkaavuudet:**

555345S   Advanced Course in Product Development   6.0 op

**ECTS Credits:**

5 ECTS credits.

**Language of instruction:**

English.

**Timing:**

Period 2.

**Learning outcomes:**

Upon completion of the course, the student will be able to:

- understand the objectives of requirements engineering (RE), design for excellence (DfX) product design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable products with minimum product specific investments
- understand requirements engineering process and its key activities, DfX product design concept as product design guidelines, targets and key performance indicators (KPIs)
- understand DCC process as a sub-process of new product development (NPD) process including key roles, tasks and milestone criteria
- analyse and further develop RM, DfX and DCC as a part of product development processes

**Contents:**

The concepts of requirements management, requirements engineering process, requirement prioritisation and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and their requirements for product development

**Mode of delivery:**

The tuition will be implemented as face-to-face teaching.

**Learning activities and teaching methods:**

Lectures 16 h / group work and self-study 119 h.

**Target group:**

Industrial Engineering and Management students.

**Prerequisites and co-requisites:**

555242A Product development, 555350S Research and Technology management (Technology Management).

**Recommended optional programme components:**

- 

**Recommended or required reading:**

Will be defined at the beginning of the course.

**Assessment methods and criteria:**

Group work, exam.

**Grading:**

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Professor Harri Haapasalo

**Working life cooperation:**

The group work will be done in cooperation with case companies.

**Other information:**

Substitutes course 555345S Advanced Course in Product Development.
555343S: Product Data and product life cycle management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3-4.

Learning outcomes:
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:
- understand the basic terminology related to product, productisation, PDM and PLM
- analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies
- create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data
- model the company’s HW, SW and Service product related commercial and technical product portfolios according to productisation concept
- understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept
- create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

Contents:
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

Mode of delivery:
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242 Product development

Recommended optional programme components:
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

Recommended or required reading:
Lecture materials and selected articles.

Assessment methods and criteria:
Group work report (50 % of the grade) and exam (50 % of the grade).
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Previous course name was 'Product Data Management'.

555346S: Product portfolio management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

Required proficiency level:

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 3-4.

Learning outcomes:
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

Contents:
Basic issues in product and product portfolio management performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

Mode of delivery:
The tuition will be implemented as face-to-face learning and practical assignments.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Technology management.
Recommended optional programme components:
-
Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
No.

Other information:
Previous course name was 'Product Management'

A440270: Complementary Module, Other Industrial Engineering and Management Studies, 20 - 30 op
Voimassaolo: 01.08.2017 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikko: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Ei opintojaksokuvausia.

Elective studies (max 10 cr)

555226A: Operations and supply chain management, 5 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikko: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Farzad Pargar
Opintokohteen kielet: English
Leikkaavuudet:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>555222A</td>
<td>Demonstration in Industrial Engineering and Management</td>
<td>2.0</td>
</tr>
<tr>
<td>555223A</td>
<td>Introduction to Production Control</td>
<td>3.0</td>
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ECTS Credits:
5 ECTS credits
Language of instruction:
English.
Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- describe different production types
- apply different forecasting methods, plan needed production capacity, and apply location and transportation decisions related methods
- master common inventory management methods and aggregated and short-term scheduling
- create a sales and operations plan for a company

Contents:
Production types, forecasting methods, capacity planning and queuing models, location and transportation decisions, inventory management systems, aggregate scheduling, MRP & ERP, short-term scheduling, linear programming.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures 16 hours / independent studying 64 hours.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management or similar knowledge.

Recommended optional programme components:
Industrial Engineering and Management students will complete 902143Y Company presentations course simultaneously.

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. During the course, there are mandatory weekly assignments. At least half of the assignments must be passed. 40 % of the grade is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Post-doctoral researcher Farzad Pargar.

Working life cooperation:
The group work will be done for a real company by using public information sources.

Other information:
Substitutes course 555222A Demonstration in Industrial Engineering and Management 2 ECTS cr and 555223A Introduction to Production Control 3 ECTS cr.
Previous course name was 'Operations and Production'.

555242A: Product development, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysiksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Learning outcomes:
This course introduces product development and innovations management in a company environment. The course provides fundamental understanding over tools and frameworks that can be used for analysing and managing products, innovations, and technology development. The aim is to create a connection between product development and other company functions. Upon completion of the course, the student will be able to:

- explain the role of product development as a company function
- understand the difference between innovation activities and systematic product development, and knows the difference between different phases of product development process and its activities
- transform customer needs into requirements for product development process and finally into product features
- define the meaning of other company functions to product development activities

Contents:
Meaning of products for the operations of an industrial enterprise, product development paradigm and defining relevant concepts, realising product development methodologically (U&E model, Cooper's stage-gate model, QFD), managing innovations, and product development success factors.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 20 h / exercises 6 h / group work and self-study 108 h.

Target group:
Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555226A Operations and supply chain management (Operations and production)

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo.

Working life cooperation:
No.
Other information:
Substitutes course 555240A Basic Course in Product Development.

555285A: Project management, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

- 555288A Project Management 5.0 op
- ay555285A Project management (OPEN UNI) 5.0 op
- 555282A Project Management 4.0 op
- 555280P Basic Course of Project Management 2.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. Check the course in English 555288A Project Management.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- describe explain the essential concepts and methods related to project management
- apply project management methods to create a schedule for a project and calculate critical path
- understand essential concepts related to project cost management and able to apply earned value method and three point estimate to manage project costs
- recognises the essential tasks of project risk management

Contents:
Defining project management, project goals and objectives, project phases and project life-cycle management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management, project stakeholder management, project communications management, the role of project manager, new modes of project delivery

Mode of delivery:
The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:
Web-based lectures 16h, self-study 118h

Target group:
Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
No prerequisites exist.

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

**Recommended or required reading:**
Lecture material, exercise book, Artto, Martinsuo & Kujala 2006. Projektiliketoiminta. WSOY

**Assessment methods and criteria:**
Weekly assignments and final online exam

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Assistant professor Kirsi Aaltonen

**Working life cooperation:**
Videos from the industry’s projects

**Other information:**
Substitutes courses 555280P Basic Course of Project Management + 555282A Project Management.

555286A: Process and quality management, 5 op

**Voimassaolo:** 01.01.2014 - 
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**
- ay555286A  Process and quality management (OPEN UNI)  5.0 op
- 555281A  Basic Course of Quality Management  5.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish.

**Timing:**
Period 4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- explain the role of process and quality management in a business organisation
- develop business processes based on the principles of quality management and appropriate tool

**Contents:**
Foundations of total quality management, planning of quality, performance measurement, process management, people management in relation to quality management, implantation of total quality management.

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).
Learning activities and teaching methods:
20 h lectures, 114 h independent study

Target group:
Industrial Engineering and Management students and other students studying Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
-

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, and 555264P Managing well-being and quality of working life.

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must pass the weekly course exercises (50 % of the course grade) and an exam (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555281A Basic Course of Quality Management.

Elective advanced studies

555377S: Risk Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:

| ECTS Credits: | 5 ECTS credits. |

Language of instruction:
English

Timing:
Period 2.
Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the key concepts of enterprise risk management and uncertainty management
- explain the role of risk management in organisations and compare the specific features of risk management in different organisational contexts
- identify and classify risks and conduct systematic risk analyses in organisations
- make informed improvement suggestions related to enterprise risk management in organisations
- to develop enterprise risk management processes in organisations

Contents:
Definitions of risk and uncertainty, risk management standards, risk classification models, systematic risk management process, methods of risk management, psychological aspects of risk management, ERM and organising of risk management, risk management in different contexts, risk governance.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 26 h (lectures 26h), self-study 42h, group assignment and cases 66 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture. The materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant Professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555321S Risk Management.

555376S: Sustainable organisational development, 5 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: Finnish
Leikkaavuudet:

555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used (the course can be completed in English by the group work and examination).

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the general models regarding sustainable organisational development
- adapt the most central ones to the work organisations
- choose the most suitable models for different situations and can interpret the results gained from different approaches
- explain the most important quantitative and qualitative variables that are either preconditions or results of the operation of the organisation
- identify development needs and opportunities in companies and other organisations.

Contents:
The development of organisation is examined through e.g. the following concepts: productivity, well-being at work, quality control, quality of working life, safety and security, and responsibility. Various concepts and indicators will be discussed, for example, in relation with change processes (e.g. strategy, owner, partnerships, sizes of operations and personnel), implementation, participation, intervention, action research, and learning organisation.

Mode of delivery:
The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:
Face-to-face teaching 18 h (lectures 18 h, exercises and group work 16 h), self-study 100 h).

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555265P Occupational safety and health management, 555264P Managing well-being and quality of working life, 555371S Human resource management.

Recommended optional programme components:
555371S Human resource management, 555370S Strategic management, 555377S Risk Management. Research project in industrial engineering and management related to Organisation and knowledge management topic and Faculty of Education’s Organisational psychology course can be conducted to complement this course.

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment including exercises during the lectures (weight 20 %), group work (weight 50 %) and examination (weight 30 %).
Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Arto Reiman

Working life cooperation:
-

Other information:
Previous course name was Organisational Development.
Substitutes course 555360S Administration, Organization and Education in Working Life.

555378S: Seminar in industrial engineering and management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppiла
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555385S  Advanced Course in Quality Management  5.0 op
  555386S  Advanced Course in Project Management  5.0 op
  555347S  Seminar in Technology Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English.

Timing:
Periods 1-4.

Learning outcomes:
Learning outcomes depend on the content of each seminar. The seminar topics are related to production management, product management, organization and knowledge management, project management, and process and quality management.

Contents:
Will be defined at the beginning of the course.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.
Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:

Other information:

555379S: Research Project in Industrial Engineering and Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555367S  Exercises in Work Science   6.0 op
  555387S  Project Work in Quality Management   5.0 op
  555388S  Project Work in Project Management   5.0 op
  555326S  Research Project in Production Management   5.0 op
  555348S  Research Project in Technology Management   5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English

Timing:
Periods 1-4 or as summer studies independently

Learning outcomes:
Learning outcomes depend on the project work contents.

Contents:
Project work topics and types vary. The topics are typically related to actual problems in the industry.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
The methods are agreed with the project work instructor. The work can be done individually or in a group.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-
Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
The assessment is based on the project work report.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
The objective of the course is to apply the methods of industrial engineering and management in a company’s development activities. The course provides the student with an opportunity to combine and apply his/her existing knowledge in a study project. The student familiarises himself/herself with research work and reporting of the results.

Project Management

555391S: Advanced Course in Project Management, 5 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:

555381S  Project Leadership  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain and describe the most important project management areas and tools
- identify and evaluate the most applicable managerial approaches for different types of projects
- identify development needs and opportunities in project-based organisations
- to develop project management processes in an organisation

Contents:
different type of projects and industry specific approaches to project management, agile project management, managing large international projects, project governance, project risk and uncertainty management, project time and schedule management, management of innovative projects.

**Mode of delivery:**
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

**Learning activities and teaching methods:**
Lectures, web-based-lectures and workshops 26h, group exercises and cases 66h, self-study 42h.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
555285A Basic course in project management.

**Recommended optional programme components:**
-

**Recommended or required reading:**
Lecture materials and reading materials (articles, book chapters) related to each lecture.

**Assessment methods and criteria:**
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Assistant professor Kirsi Aaltonen

**Working life cooperation:**
The course includes guest lectures from industry.

**Other information:**
Substitutes course 555381S Project Leadership.

**555382S: Management of a project-based firm, 5 op**

**Opiskelumuoto:** Advanced Studies  
**Laji:** Course  
**Vastuuyksikkö:** Field of Industrial Engineering and Management  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Jaakko Kujala  
**Opintokohteen kielet:** Finnish  
**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.
Timing:
Period 4.

Learning outcomes:
Upon completion of the course student will be able to:
- describe the core areas of the management of the project-based firm
- explain how different internal and external contextual factors affect the business of a project-based firm, and how they should be taken account in the design of a business model
- understand the role of services in the business of a project-based firm
- apply systematic approach to project negotiation
- evaluate the significance of a single project for the business of a project based-firm

Contents:
Contextual factors in project business, business model of a project-based firm, integration of services to the business of a project-based firm, project sales and marketing, contracting, project negotiations (negotiation analytic approach) and organising support functions in project-based firm.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 24h / self-study56h / group exercise 54h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Lecture materials. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
The course utilises continuous assessment. During the course, the students must write a learning diary for each lecture and participate actively in the lectures. 40% of the grade is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Jaakko Kujala

Working life cooperation:
Group work will be done for a project-based firm or public sector organisation.

Other information:
Timing in academic year 2021-22 is 3rd period.

Organization and knowledge management

555370S: Strategic Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:

555320S Strategic Management 5.0 op
ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
- utilise strategic thinking, planning, and management
- analyse and plan complex global business operations
- participate in strategic planning and strategy implementation in organisations
- apply strategy analysis frameworks and analyse the implementation of the chosen strategy

Contents:
Strategic thinking, strategic planning, strategic management, strategy analysis frameworks, strategy implementation with a simulation, analysis of the strategy implementation.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 12 h (lectures 6 h, exercises 6 h), group work 122 h. Alternatively independent learning method: book examination 134 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. The group work includes the creation of strategic plan (10 % of the grade), business simulation (30 % of the grade), and the analysis of the strategy (60 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
-

Other information:
Substitutes course 555320S Strategic Management.

555371S: Human Resource Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysiköt: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman  
Opintokohteen kielet: English  
Leikkaavuudet:  
555360S Administration, Organization and Education in Working Life  5.0 op  

ECTS Credits:  
5 ECTS credits.  
Language of instruction:  
English.  
Timing:  
Period 4.  

Learning outcomes:  
Upon completion of the course, the student will be able to:  
- understand the key concepts of human resource management  
- utilise methods in analysing and planning of human resource practices in organisations  
- participate in human resource practices planning and implementation in organisations  
- apply PCMM (People Capability Maturity Model) frameworks  
- know the basic Finnish laws, bylaws and trade agreements in the area of human resource management  

Contents:  

Mode of delivery:  
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).  

Learning activities and teaching methods:  
Face-to-face teaching 20 h (lectures 10 h, assignment guidance 10 h), group work 114 h.  

Target group:  
Industrial Engineering and Management students.  

Prerequisites and co-requisites:  
B.Sc. in Industrial Engineering and Management or equivalent.  

Recommended optional programme components:  
-  

Recommended or required reading:  

Assessment methods and criteria:  
The assessment is based on the group work.  

Grading:  
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.  

Person responsible:  
Postdoctoral Researcher Arto Reiman  

Working life cooperation:  
The group work is done in cooperation with case companies.  

Process and Quality Management
Upon completion of the course, the student will be able to:

- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS credits.

Language of instruction:
Finnish

Timing:
Periods 1 - 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:
Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:
The tuition will be implemented as blended teaching.

Learning activities and teaching methods:
Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:
Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:
Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
a group exercise related to a process operating in practice.

Other information:

Product Management

555350S: Research and Technology Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:

- 555340S Technology Management 4.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the differences between product development and technology management in a company
- piece together the development needs and cycles of technologies in an organisation
- combine technology development and technology management with strategic planning of a company

Contents:
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquirement, and transition

Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:

-  

Recommended or required reading:
Lecture materials and articles.
Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry

Other information:
Previous course name was 'Technology Management'. Substitutes course 555340S Technology Management.

555351S: Advanced Course in Product Development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintoohje kielet: English
Leikkaavuudet:

555345S Advanced Course in Product Development 6.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:

- understand the objectives of requirements engineering (RE), design for excellence (DfX) product design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable products with minimum product specific investments
- understand requirements engineering process and its key activities, DfX product design concept as product design guidelines, targets and key performance indicators (KPIs)
- understand DCC process as a sub-process of new product development (NPD) process including key roles, tasks and milestone criteria
- analyse and further develop RM, DfX and DCC as a part of product development processes

Contents:
The concepts of requirements management, requirements engineering process, requirement prioritisation and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and their requirements for product development

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 16 h / group work and self-study 119 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
Recommended optional programme components:

- 

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Group work, exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Substitutes course 555345S Advanced Course in Product Development.

555343S: Product Data and product life cycle management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.
Language of instruction:
English.
Timing:
Period 3-4.

Learning outcomes:
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:
- understand the basic terminology related to product, productisation, PDM and PLM
- analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies
- create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data
- model the company’s HW, SW and Service product related commercial and technical product portfolios according to productisation concept
- understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept
- create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

Contents:
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

**Learning activities and teaching methods:**
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
555242 Product development

**Recommended optional programme components:**
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

**Recommended or required reading:**
Lecture materials and selected articles.

**Assessment methods and criteria:**
Group work report (50 % of the grade) and exam (50 % of the grade).

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Erno Mustonen

**Working life cooperation:**
The group work will be done in cooperation with case companies.

**Other information:**
Previous course name was ‘Product Data Management’.

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**555346S: Product portfolio management, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Erno Mustonen

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

**Required proficiency level:**

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Periods 3-4.

**Learning outcomes:**
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

Contents:
Basic issues in product and product portfolio management, performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

Mode of delivery:
The tuition will be implemented as face-to-face learning and practical assignments.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Technology management.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
No.

Other information:
Previous course name was ‘Product Management’
ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.

Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.

Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 hrs (lectures/ assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

Target group:
Industrial Engineering Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Lecture notes. Other material will be defined at the beginning of the course

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555323S Sourcing Management.

555331S: Advanced Supply Chain Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:
555324S Advanced Supply Chain Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used.

Timing:
Periods 3-4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management
- develop and analyse supply networks and create development proposals to improve productivity and competitiveness
- understand the importance of risk management in supply networks
- know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

Contents:
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 16 h (lectures/ group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course

Assessment methods and criteria:
The grade will be based on the group work (60 % of the grade) and book examination (40 % of the grade).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Associate professor Jukka Majava

Working life cooperation:
Case organisations’ supply chain related data is utilised in the group works.

Other information:
-
**55532S: Operations and supply network analytics, 5 op**

- **Voimassaolo:** 01.08.2015 -
- **Opiskelumuoto:** Advanced Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Osmo Kauppila
- **Opintokohteen kiele:** Finnish

**Leikkaavuudet:**

555342S Operations Research 5.0 op

**ECTS Credits:**

5 ECTS credits.

**Language of instruction:**

English

**Timing:**

Period 4.

**Learning outcomes:**

Upon completion of the course, the student will be able to:

- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

**Contents:**

What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

**Mode of delivery:**

The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).

**Learning activities and teaching methods:**

Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

**Target group:**

Industrial engineering and management students.

**Prerequisites and co-requisites:**

Bachelor in industrial engineering and management or equivalent.

**Recommended optional programme components:**

- 

**Recommended or required reading:**


**Assessment methods and criteria:**

To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50%).

**Grading:**

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

University lecturer Osmo Kauppila

**Working life cooperation:**

No.
Other information:
Substitutes course 555342S Operations Research.

555333S: Production Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:

555322S Production Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production

Contents:
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108 hrs.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

A440253: Supplementary Module, Electrical Engineering, 20 - 30 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Electronics

521432A: Electronics Design I, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Nissinen
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
Finnish.

Timing:
Spring, period 4.

Learning outcomes:
1. should be able to recount the principles covering the design of multistage amplifiers
2. should be able to analyze and set the frequency response of a transistor amplifier

3. should be able to make use of feedback to improve the properties of an amplifier in the desired manner

4. should be able to analyze the stability of a given degree of feedback amplification and to dimension an amplifier correctly to ensure stability

5. should be able to describe the principles governing the design of power amplifiers

6. should be able to make widespread use of operational amplifiers for realizing electronic circuits and to take account of the limitations imposed by the non-idealities inherent in operational amplifiers

7. should be able to design low-frequency oscillators, to explain the operating principles of radio frequency oscillators and tuned amplifiers

Contents:
Frequency response of a transistor amplifier, differential amplifier, feedback, power amplifiers, oscillators and tuned amplifiers, non-idealities of an operational amplifier, applications of operational amplifiers.

Mode of delivery:
Remote teaching.

Learning activities and teaching methods:
Link to Moodle will be given later. Lectures 30 h and exercises 20 h.

Target group:
Students of Electrical engineering. Other students of the University of Oulu may also participate.

Prerequisites and co-requisites:
Principles of electronic design

Recommended optional programme components:
This course is required when participating in Laboratory Exercises on Analogue Electronics.

Recommended or required reading:
John Wiley & Sons 2015

Assessment methods and criteria:
Final or 2 mid-term exams.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5.

Person responsible:
Ilkka Nissinen

Working life cooperation:
-

Other information:
-

521070A: Introduction to Microfabrication Techniques, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Niina Halonen
Opintokohteen kielet: Finnish
Introduction to Microelectronics and Micromechanics

ECTS Credits: 5
Language of instruction: Finnish
Timing: 2nd period
Learning outcomes:
1. Can present the process of source materials used to manufacture micro- and nanoelectronics/mechanics and analyse the required material properties depending of the application
2. Can explain the fabrication methods and discuss the characteristic features of each fabrication method, including their utilisation and restrictions.
3. Is capable of designing a fabrication process for a simple microelectronics application and is able to identify the process steps also in complex application.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (20 hours) and exercises (10 +10).

Target group:
Electrical engineering bachelor degree students.

Prerequisites and co-requisites:
Course content of 521104P Introduction to Materials Physics and 521071A Principles of Semiconductor Devices.

Recommended optional programme components:

Recommended or required reading:
Lecture notes, Franssila Sami: Introduction to Microfabrication

Assessment methods and criteria:
Final written exam and passes laboratory exercises.

Grading:
Numerical grading 1-5.

Person responsible:
Merja Teirikangas

Working life cooperation:
No

521404A: Digital Techniques 2, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
**ECTS Credits:**
5

**Language of instruction:**
In Finnish. Exams can be arranged in English on demand.

**Timing:**
Autumn, period 2

**Learning outcomes:**
1. knows the common architectures of synchronous digital logic circuits, and the building blocks they consist of, and can design digital circuits that realize complex data and signal processing functions.
2. knows most common combinational and sequential logic based building blocks, and can use them to design and realize complex digital circuits.
3. knows digital logic design methods, such as use of hardware description languages, functional verification using simulation, realization of logic with a logic synthesis program, and functional and timing verification of gate-level models.

**Contents:**

**Mode of delivery:**
Classroom

**Learning activities and teaching methods:**
Lectures 24h/ exercises 30h (group work)/independent work 84h.

**Target group:**
Primarily electrical and computer science and engineering students. Also other student of University of Oulu can take the course.

**Prerequisites and co-requisites:**
Digital techniques 1

**Recommended optional programme components:**
No

**Recommended or required reading:**
Lecture textbook (in finnish) and literature announced during course.

**Assessment methods and criteria:**
Final exam and a design excercise, or weekly assignments consisting of theoretical and design exercises. Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
1-5, The grade is the average of the exam and the design exercise.

**Person responsible:**
Jukka Lahti

**Working life cooperation:**
No

**Other information:**
Learning outcomes:
1. is able to design basic electronic structural blocks and verify their functionality in a CAD simulation environment.
2. is able independently to realize and test a small-scale design object employing analogue circuit techniques.

Design exercises to deepen the understanding of the material presented in Principles of Electronics Design and Analogue Electronics I.

Contents:
Passive RC-circuits, diodes and their applications, bipolar transistor amplifiers, operational amplifiers and their applications, MOS-transistor, tuned circuit and amplifier, oscillator.

Mode of delivery:
Face-to-face teaching, partially independent work

Learning activities and teaching methods:
Independent design and simulating excercise 26 h and guided laboratory work 15 h. Group size is 1 - 2 students.

Target group:
Primarily in electrical engineering students. Other University of Oulu students can complete the course.

Prerequisites and co-requisites:
Student must participate to courses Principles of Electronics Design and Electronics Design I, or he/she must have passed these courses earlier.

Recommended optional programme components:
No

Recommended or required reading:
Lecture notes of Principles of Electronic design and Electronics design 1.

Assessment methods and criteria:
Teacher accepts student’s design work and measurement results in laboratory. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes verbal grading scale pass or fail

Person responsible:
Kari Määttä

Working life cooperation:
521075S: Microelectronics Packaging Technologies, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Sami Myllymäki
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
Finnish

Timing:
3rd period

Learning outcomes:
1. Upon completing the course student can explain how electronics packaging technology has since invention of transistors to current date and can estimate how this development is going to continue in future.
2. The student can describe can explain what is meant by microjoining techniques and what are the pros and cons of these.
3. The student can tell what different kind of materials, and why, are used in IC packaging technology.
4. The student can explain what is meant with system level packaging and how the strong miniaturization on IC requires new system level packaging techniques to be developed.
5. He can explain why active and passive components are being, more and more, embedded to be a part of the circuit board.
6. In addition, he can explain why and how radio electronics will be migrate towards circuit board and components on it.

Contents:

Mode of delivery:
Face to face teaching

Learning activities and teaching methods:
Lecturing 24 h, practical work 12 h.

Target group:
Primarily major students of electrical engineering.

Prerequisites and co-requisites:
Recommended Introduction to Microfabrication Techniques.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course is completed with the final exam and finished course work.
**Grading:**
The course unit utilizes a numerical grading scale 1-5.

**Person responsible:**
Sami Myllymäki

**Working life cooperation:**
No

**Other information:**

521089S: Printed Electronics, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Electrical Engineering DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tapio Fabritius

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 521217S  Printed Electronics  4.0 op
- 521095S  Advanced Course of Printed Electronics  3.0 op

**ECTS Credits:**
5

**Language of instruction:**
Finnish. English if more than two international students in the course.

**Timing:**
Period 3.

**Learning outcomes:**
1. Knows the most typical materials and printing methods suitable for their processing
2. Can explain the principles of materials and printing methods
3. Can utilize the material and manufacturing process knowledge to design fabrication processes for electrical components
4. Can analyse how the selected materials and printing methods influence on the performance of electrical components

**Contents:**
Materials (conductive and semi-conductive polymers, photoactive polymers, dielectrics, particle based inks) and processing methods (screen printing, gravure printing, flexo printing, inkjet) utilized in printed electronics, surface wetting and film formation, printed electrical components (passive components, solar cells, light emitting diodes, transistors) and their fabrication. Possibilities and challenges of printing based processing methods and how to take them into account in the printed electronics fabrication.

**Mode of delivery:**
Face-to-face teaching.

**Learning activities and teaching methods:**
Combined lectures and exercises 30 h and self-study 100 h

**Target group:**
Primarily for the students of electrical engineering

**Prerequisites and co-requisites:**
None.

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time
Recommended or required reading:
D.R. Gamota, P. Brazis, K. Kalyanasundaram and J. Zhang, "Printed organic and molecular electronics", handout

Assessment methods and criteria:
Course is completed by final examination.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Tapio Fabritius

Working life cooperation:
Not included.

521098S: Testing Techniques of Electronics and Printed Electronics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Fabritius
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
Finnish. English, if there are more than 2 foreign students.

Timing:
Period 4.

Learning outcomes:
1. After completing the course the student is able to analyze different kinds of testing strategies, and is able to enhance the testability of electronics through the use of design for testability.
2. The student can also compare different testing techniques of analogue and digital electronics, which have been implemented using either embedded testing methods or external automatic testing equipment.
3. Additionally, the student is able to analyze tests made using an automatic test instrument, compare different test interfaces and data busses, and recognizes principles of design of a high-quality printed test circuit board.
4. The Student understands the specific features of printed electronics having an influence on electronics testing and reliability.

Contents:
Overview of different testing methods, constructions of testers, test fixtures, test signal generation and measurement, mixed-signal test buses, DC- and parametric measurements, dynamic tests, AD/DA converter tests, DSP-based tests, data analysis, embedded testing, design for testability, Boundary scan, test applications.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 26h/Exercises 14h and self-studying 100 h.

Target group:
Course is compulsory for the Electrical engineering students in the advanced module of Testing techniques and printed electronics.

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course unit: Electronics Design I, Electronic Measurement Techniques.

Recommended optional programme components:
This course compensates 521098S Testing Techniques of Electronics if the student hasn’t got credits from it.

Recommended or required reading:
M. Burns, G. W. Roberts: An Introduction to Mixed-Signal IC Test and Measurement, Lecture slides. Additional material will be announced at the beginning of the course.

Assessment methods and criteria:
Exam and passed lab exercises. Read more about assessment criteria at the University of Oulu webpage.

Grading:
Grade is based on exam and grade is on numerical scale 1-5.

Person responsible:
Tapio Fabritius

Working life cooperation:
No.

Wireless communication engineering

521303A: Circuit Theory 2, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Rahkonen, Timo Erkki
Opintokohteen kielet: Finnish
Leikkaavuudet:
      521306A  Circuit Theory 2  4.0 op

ECTS Credits:
5

Language of instruction:
Finnish

Timing:
Autumn, period 2

Learning outcomes:
After the course the student can:
1. use Laplace transform for solving time and frequency response of electric circuits;
2. derive continuous-time transfer functions.;
3. solve their poles and zeros and understand the meaning of those;
4. draw the pole-zero map and Bode plots of any given transfer function;
5. construct 2-port parameter models of a given circuit

Contents:
Use of Laplace transform in network analysis. Properties of network functions, poles and zeros, Boden magnitude and phase plots. 2-port parameter models.

**Mode of delivery:**
Classroom

**Learning activities and teaching methods:**
30h lectures, 22 h exercises, and simulation exercises.

**Target group:**
Finnish BSc students

**Prerequisites and co-requisites:**
Basics of circuit theory, differential equations.

**Recommended optional programme components:**
Continuation for Circuit theory 1. Needed in most analog electronics courses.

**Recommended or required reading:**

**Assessment methods and criteria:**
Final exam. Also the simulation exercise must be passed.
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
Numerical 1-5

**Person responsible:**
Prof. Timo Rahkonen

**Working life cooperation:**
-

**521384A: Basics in Radio Engineering, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Electrical Engineering DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Risto Vuonthiemi, Aarno Pärssinen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5

**Language of instruction:**
Finnish

**Timing:**
Autumn, 1st period

**Learning outcomes:**
1. can define what radio engineering is and list its separate areas and applications from FM-radio to 5G systems.

2. understands the meaning of Maxwell's equations and can solve the propagation of radio waves in a homogeneous medium.

3. can solve EM-fields at an interface of two lossless media.

4. knows main properties of most common transmission line types and can solve EM-fields for coaxial lines and rectangular waveguides.

5. can utilize the methods based on the Smith chart for the impedance matching of microwave circuits and
6. understands the meaning of Y-, Z-, and S-matrix and can use S-parameters for solving characteristics of microwave circuits.

7. can describe the operation of passive transmission line devices, resonators, filters and circuits based on the semiconductor devices.

8. knows the terms to describe antenna characteristics and can define radiation patterns of simple antennas and antenna arrays.

9. knows different propagation phenomena and can evaluate, which phenomena are relevant in different radio systems in different frequency bands.

10. can describe the structure of a typical radio system and can calculate the S/N-ratio link budget for a radio system on a free-space radio link.

Contents:

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 26 h and exercises 16 h including graded exercise problems.

Target group:
3rd year bachelor's degree students.

Prerequisites and co-requisites:
Elementary knowledge of the electromagnetic theory.

Recommended optional programme components:
-

Recommended or required reading:
In Finnish: Antti Räisänen & Arto Lehto: Radiotekniikan perusteet. Otatieto, 2011; also older versions of the book can be used as a course book.

Assessment methods and criteria:
The course is passed with a final examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5.

Person responsible:
Risto Vuohtoniemi, Aarno Pärssinen.

Working life cooperation:
No

Other information:
-

521304A: Filters, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Rahkonen, Timo Erkki
Opintokohteen kielet: Finnish
Leikkaavuudet:
  521331A Filters 4.0 op

ECTS Credits:
5

Language of instruction:
Finnish. Exams can be arranged in English on demand.

Timing:
Spring, period 3

Learning outcomes:
After the course the student can:
1. draw a pole-zero map for a given transfer function;
2. perform impedance and frequency scaling for component values;
3. choose an appropriate prototype filter and filter degree;
4. synthesize passive RLC filters;
5. synthesize active opamp based filters;
6. can compare various filter technologies;
7. understands the basics of scaling the dynamic range of active filters

Contents:
Filter types and prototypes, component scaling. Synthesis of active and passive filters. Sensitivity analysis and scaling of the dynamic range.

Mode of delivery:
Lectures, exercise and design excercise

Learning activities and teaching methods:
30 h lectures, 16 h exercises. A design excercise.

Target group:
Finnish electrical engineering students

Prerequisites and co-requisites:
Basics of circuit theory, Bode plots and analog design.

Recommended optional programme components:
Course Digital filters expands the topic into digital domain.

Recommended or required reading:

Assessment methods and criteria:
Circuit is examined by a final exam. Also the obligatory design exercise must be passed.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
1-5

Person responsible:
Prof. Timo Rahkonen

Working life cooperation:

Other information:
521395S: Wireless Communications I, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Timo Kokkonen, Jari Iinatti
Opintokohteen kielet: English
Leikkaavuudet:

521395S-01 Wireless Communications I, Exam 0.0 op
521395S-02 Wireless Communications I, Exercise 0.0 op
521323S Wireless Communications 2 5.0 op
521323S-02 Wireless Communications I, Exercise 0.0 op
521320S Wireless Communications 2 8.0 op
521320S-01 Intermediate exam or final exam, Wireless Communications 1 0.0 op
521320S-02 Exercisework, Wireless Communications 2 0.0 op
521323S-01 Wireless Communications I, Exam 0.0 op

ECTS Credits:
5

Language of instruction:
English

Timing:
Fall, period 1

Learning outcomes:
Student
1. can analyze the performance of multilevel digital modulation methods in AWGN channel
2. can explain the effect of fading channel on the performance of the modulation method and can analyze the performance
3. recognizes and understand suitable diversity methods for fading channel and related combining methods
4. can understand and explain coding methods for wireless channels
5. recognizes different wideband systems
6. understands the cellular system principle

Contents:
Radio channel models, digital modulation and detection methods, carrier and symbol synchronization, performance of digital modulation in AWGN and fading channel, diversity techniques, coding for wireless channel, multicarrier modulation, spread spectrum, cellular systems.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercise (total 40 hours) and the compulsory design work with a simulation program.

Target group:
1st year WCE students and M.Sc. students (i.e., 4th year in ECE degree programme)

Prerequisites and co-requisites:
521330A Telecommunication Engineering

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
The course is passed with minor exams (only during lecture period) or with final exam; and the accepted
design work report. In the final grade of the course, the weight for the examination(s) is 0.6 and that for the
design work report 0.4.

Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jari Iinatti / Timo Kokkonen

Working life cooperation:
Visiting lecturers from industry.

Other information:

521340S: Communications Networks I, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Mika Ylianttila
Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr

Language of instruction:
English

Timing:
Fall, period 2

Learning outcomes:

1. Students understand how the modern communications networks have evolved and how the
architecture has changed through the recent paradigm shift towards software-centric
communications.
2. Students are able to describe the basic system architecture elements of mobile networks, and
understands the significance of emerging technologies such as Network Function Virtualization
(NFV), Software Defined Networking (SDN), and core network functionalities such as Evolved
Packet Core (EPC).
3. Students can describe the main principles of mobility management, network management and
orchestration, and network security, and can apply and solve related engineering problems.
4. Students know the basic properties of routing algorithms, and can use graph theory to solve network
routing problems.
5. Students are able to simulate different types of networks in simulation environments and solve basic
network programming problems. Upon completing the required coursework, students understand the
basic functionalities in TCP/IP protocol stack.

Contents:
Communications architecture in mobile, wireless local area and personal area networks. Introduction to
cloud and edge computing, network function virtualization and software defined networking. Basic
principles of mobility management, network security, network management and orchestration. The goal is
to present the basics of the modern communications architectures, and their technical implementation.

Mode of delivery:
Due to Covid-19 pandemic, teaching in Autumn 2020 will be implemented remotely. Details of arrangement
can be found from the course web page, which will be available in Moodle.
https://moodle.oulu.fi/course/view.php?id=1454

Learning activities and teaching methods:
Lectures 30 h and the compulsory design work (15 h). Design work can be done alternatively either as NS-2 simulation or TCP/IP programming exercise. Design work instructions are provided in digital learning environment (Moodle).

**Target group:**
1st year M.Sc. and WCE students

**Prerequisites and co-requisites:**
-

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Software Defined Mobile Networks (SDMN): Beyond LTE Network Architecture, M Liyanage, A Gurtov, M Ylianttila – 2015; A comprehensive Guide to 5G Security, M Liyanage, I Ahmad, A Abro, A Gurtov, M Ylianttila – 2018; In addition, selected supportive online reading materials from recent standards and publications are provided in digital learning environment (Optima / Moodle).

**Assessment methods and criteria:**
The course is passed with a final examination and the accepted design work report. The final grade is based on examination.
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
The course unit utilizes a numerical grading scale 1-5.

**Person responsible:**
Mika Ylianttila

**Working life cooperation:**
No

**Other information:**
-

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**521349S: Wireless Communications II, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Electrical Engineering DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Antti-Heikki Tölli

**Opintokohteen kielet:** English

**ECTS Credits:**
5

**Language of instruction:**
English

**Timing:**
Spring, period 3

**Learning outcomes:**
1. The student is familiarised with the channel capacity as the fundamental performance measure of wireless communication links, and can explain the effect of fading channel on the capacity in a single-user single-antenna scenarios.
2. The student understands the basic principles for multiuser communications in fading channels, apprehends the notion of capacity region for multi-access and broadcast channels, and is familiarised with different practical multiple access, random access and scheduling methods.
3. The student is acquainted with core principles of adaptive transmission, which requires accurate channel estimates at the receiver and a reliable information exchange mechanisms between the receiver and transmitter. Practical variable-rate variable-power MQAM modulation techniques for fading channels are introduced.
4. The student understands the principles of transmitter and receiver design in the presence of channel distortion. The student is familiarised with various (adaptive) equalization solutions to combat intersymbol interference.

5. Finally, the student is acquainted with the capacity optimal multi-antenna transmission and reception scheme, as well as, with basic multiantenna space-time coding schemes in a single-user multiple-input multiple-output (MIMO) communications scenario.

Contents:
Capacity of wireless channels, multiuser communications, adaptive modulation and coding, equalization, point-to-point MIMO communications and space-time coding.

Mode of delivery:
Fully remotely.
https://moodle.oulu.fi/course/view.php?id=2086

Learning activities and teaching methods:
Lectures and exercise (total 40 hours) and the compulsory design work with a simulation program (20 h).

Target group:
1st year WCE students and M.Sc. students (i.e., 4th year in ECE degree programme).

Prerequisites and co-requisites:
In addition to courses “521395S Wireless Communications I”, 521348S “Statistical Signal Processing I”, 031025A “Introduction to optimization” and 031051S “Numerical matrix analysis”, a working knowledge in digital communications, random processes, linear algebra, matrix manipulation and detection theory is required.

Recommended optional programme components:
Prior knowledge of 521390S Information Theory and 521392S Convex Optimisation is very useful but not mandatory. The course 521324S Statistical Signal Processing II is recommended to be taken in parallel.

Recommended or required reading:

Assessment methods and criteria:
The course is passed with a final examination and the accepted simulation work report. The final grade is a weighted sum of exam (70%), homework (20%), and work report (10%).

Grading:
The course unit utilizes a numerical grading scale 1-5.

Person responsible:
Antti Tölli

Working life cooperation:
No

Other information:
Course replaces the old course 521317S Wireless Communications II (8cr).
Voidaan suorittaa useasti: Kyllä

Person responsible: University lecturer Osmo Kauppila

**A440265: Complementary Module, Medical and Wellness Technology, 20 - 30 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Supplementary Module
**Laji:** Study module
**Vastuuyksikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Electives*

**764327A: Virtual measurement environments, 5 op**

**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuyksikkö:** Health Sciences
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Jämsä, Timo Jaakko
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

764627S Virtual measurement environments 5.0 op

**Proficiency level:**
- 

**Status:**
- 

**Required proficiency level:**
- 

**ECTS Credits:**
5 ECTS, 135 hours of work

**Language of instruction:**
Finnish (or English)

**Timing:**
Bachelor studies, autumn term, 2nd period

**Learning outcomes:**
The student will learn how to construct software environments for measurements and data analysis important in biomedical engineering and physics

**Contents:**
The course gives basic skills to use measuring and analyzing programmes applied not only in academic research but also in R&D of the companies, and their programming environments (Matlab, LabView).

**Mode of delivery:**
Face-to-face teaching
Learning activities and teaching methods:
Lectures 12 h, project work 65 h, self-study 58 h

Target group:
Bachelor students of Medical and Wellness Technology and Physics. Also for other students of the University of Oulu.

Prerequisites and co-requisites:
Basics / basic skills in programming

Recommended optional programme components:
The course is independent entity and does not require additional studies carried out at the same time. The course can also be completed as a part of advanced studies with the course code 764327S.

Recommended or required reading:
Lecture and exercise notes, other given material

Assessment methods and criteria:
Completion of projects. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5 or fail. In the numerical grading scale zero stands for a fail. Grading is made based on the projects.

Person responsible:
Professor Timo Jämsä

Working life cooperation:
-

Other information:
-

521273S: Biosignal Processing I, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Seppänén, Zalan Rajna
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
The course unit is held in the autumn semester, during period 2. It is recommended to complete the course at the master’s degree level.

Learning outcomes:
After completing the course, student:
1. knows about special characteristics of the biosignals and typical signal processing methods
2. can solve small-scale problems related to biosignal analysis
3. implement small-scale MATLAB software for signal processing algorithms.

Contents:

Mode of delivery:
Face-to-face teaching and guided laboratory work. The laboratory work can alternatively be performed on an online system (MathWorks Grader). Student can do the lab works remotely or in the lab using the same online system.

**Learning activities and teaching methods:**

Lectures 12h, Laboratory work 24h, Self-study for laboratory working and examination 99 h.

**Target group:**

Students interested in digital signal processing applications in biomedical engineering, at their master’s level studies.

**Prerequisites and co-requisites:**

The mathematic studies of the candidate degree program of computer science and engineering, or equivalent. Programming skills, especially basics of the MATLAB. Basic knowledge of digital signal processing.

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

The course is based on selected chapters of the book "Biomedical Signal Analysis", R.M Rangayyan, 2nd edition (2015). + Lecture slides + Task assignment specific material.

**Assessment methods and criteria:**

Face-to-face lectures. Students solve the programming problems in the laboratory work independently, supervised by assistants. The MathWorks Grader online system is used for programming tasks and it also verifies the completed tasks. Written examination.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Tapio Seppänen

**Working life cooperation:**

No.

**080929S: Health Technology and Multimodal Monitoring, 5 op**

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Teemu Myllylää
Opintokohteen kielet: English

**Proficiency level:**

-

**Status:**

-

**Required proficiency level:**

-

**ECTS Credits:**

5 ECTS credit points /135 hours of work

**Language of instruction:**

English

**Timing:**

The course is held in the Spring semester, during period III.
Learning outcomes:
The course provides students with a broad overview of the health technology that is currently in development and becoming for home and/or clinical use. Students learn the concepts of multimodal monitoring and examples of its usage in clinical applications and in medical research (including human and animal studies).

Contents:
Multimodal monitoring is increasingly being employed in clinical monitoring and in the study of human physiology. It is the simultaneous measurement of multiple physiological parameters to provide better context for their interpretation and correlations, and to enable studies of relationships between different physiological signals. Besides the concepts of multimodal monitoring, this course provides students a broad overview of the health technology that is currently in development and becoming for home or clinical use. Moreover, their usage in medical applications and for different study purposes (human and animal) are dealt.

Mode of delivery:
Web-based teaching + Face-to-face teaching

Learning activities and teaching methods:
Lectures, demonstrations, seminars and self-study

Target group:
Medical and biomedical engineering students

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Reading material will be provided during the course.

Assessment methods and criteria:
The assessment of the course is based on the learning outcomes of the course, based on the seminar work and exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Teemu Myllylä

Working life cooperation:
There is no working life cooperation in this course

Other information:
-

521097S: Wireless Measurements, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Christian Schuss
Opintokohteen kielet: English
Leikkaavuudet:
521114S Wireless Measurements 4.0 op
521114S-01 Wireless Measurements, exam 0.0 op
ECTS Credits:
5 ECTS credits / 128h

Language of instruction:
In English

Timing:
Period 3.

Learning outcomes:
1. can tell and justifying argument the benefits and challenges of using wireless measurement solutions
2. can apply the most important standards when designing wireless measurement solutions
3. can apply wireless technologies in industrial, traffic, environmental, home and healthcare measurements

Contents:
Basics of wireless measurement technologies and standards, wireless sensors and sensor networks, wireless building and smart home applications, wireless measurement applications in traffic, wireless environmental measurements and wireless human health monitoring.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 22h. Seminars 6-12h depending on the number of students participating the course. The students prepare seminar presentations about contemporary topics selected by themselves or proposed by the teacher and give 10 minutes presentation to other students in the seminars.

Target group:
Master level students regardless of master's programme.

Prerequisites and co-requisites:
No prerequisites, but basics of measurements systems are recomended.

Recommended optional programme components:
The course replaces previous courses with same name, but different credits and code.

Recommended or required reading:
Lecture notes and seminar reports is Optima.

Assessment methods and criteria:
The course is passed with a written final exam (70 %) and a contemporary seminar (30 %). Read more about assessment criteria at the University of Oulu webpage.

Grading:
Grade is on numerical scale 1-5.

Person responsible:
Christian Schuss

Working life cooperation:
No.

080916S: Biomechanics of Human Movement, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikko: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Jämsä, Timo Jaakko
Opintokohteen kielet: English

Proficiency level:
Status:

Required proficiency level:

ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English

Timing:
Master’s studies, spring term 4th period

Learning outcomes:
The student can describe the main challenges of movement biomechanics and principles for motion analysis.
The student understands basics of biomechanical measurement and modeling of movement.
The student can perform practical biomechanical experiments, analyze measurement data, interpret results, and report them using good scientific reporting practice.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 14h / Assignment and group work 54h / Self-study 67h. Final exam

Target group:
Master’s students of biomedical engineering, medical and wellness technology, information technology and other related degree programs. Master’s students of physics (biomedical physics). Other interested master’s and postgraduate students.

Prerequisites and co-requisites:
The student needs to have basic knowledge on statistical analysis, sensors and measurement techniques and signal processing. It is also recommended to have basic knowledge of anatomy and physiology.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. Tissue biomechanics will be studied in the course 080915S.

Recommended or required reading:
Material given during lectures

Assessment methods and criteria:
Accepted home exercises and lab assignments, exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Grading is made based on the exercise report and exam.

Person responsible:
Professor Timo Jämsä

Working life cooperation:
None
521093S: Biomedical Instrumentation, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Teemu Myllylä
Opintokohteen kielet: Finnish
Leikkaavuudet:
    521107S  Biomedical Instrumentation  6.0 op

ECTS Credits:
5

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
After the course the student is capable to explain principles, applications and design of medical instruments most commonly used in hospitals. He/she can describe the electrical safety aspects of medical instruments and can present the physiological signals commonly measured on humans. In addition the student is able to explain medical instrumentation development process and the factors affecting it. He/she also recognizes typical measurands and measuring spans and is able to plan and design a biosignal amplifier.

Contents:
Diagnostic instruments (common theories for medical devices, measurement quantities, sensors, amplifiers and registering instruments). Introduction to medical imaging and monitoring methods and instruments and physical therapy devices. Electrical safety aspects.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures/exercises 30 h and self-study 100 h.

Target group:
Students interested in biomedical measurements.

Prerequisites and co-requisites:
None

Recommended optional programme components:
Course replaces earlier courses Biomedical measurements and Biomedical instrumentation.

Recommended or required reading:

Assessment methods and criteria:
The course is passed by the final exam or optionally with the assignments/test agreed at the first lecture. Read more about assessment criteria at the University of Oulu webpage.

Grading:
1 - 5.
Person responsible:
Teemu Myllylä

Working life cooperation:
No.

080927S: Connected Health and mHealth, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Jarmo Reponen
Opintokohteen kielet: English

Proficiency level:
-

Status:
-

Required proficiency level:
-

ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English

Timing:
The course is held in the autumn semester period I (1st period)

Learning outcomes:

Upon completion of the course:
- The students will have knowledge about the current overall status of clinical use of health information systems and related tools (e.g. e-Health, telemedicine, Virtual Hospital, ODA-portal and other self-care portals) in Finland.
- The students will have knowledge about the state of the art development in mobile health technology solutions and connected health projects.
- The students have been introduced to some practical development examples taking place in OYS Testlab and possibly in other Oulu health test labs.
- The students have had an opportunity to consult with some enterprises currently working in the m-Health / Connected health domain.
- Depending on the student composition of the course, the students have learned collaboration and co-creation in a multiprofessional environment in the medical information and communication technology domain.

Contents:

- terms and concepts
- overview of information and communication technology and information systems in Finnish healthcare
- new processes that activate patient: virtual hospital, self-care models
- current update about mHealth, Connected Health, Artificial Intelligence in health care, secondary use of healthcare information
- collaborative development process in multiprofessional healthcare environment
- introduction to test laboratories
- case example, depending of current R&D&D work at the time of course
- web discussions and possible group assignments
Mode of delivery:
Blended teaching

Learning activities and teaching methods:
The implementation methods of the course vary. The course will consist of a combination of self-learning materials and activating workshops and other modules. The below mentioned numbers of hours are approximations, because the actual contents will vary according to available development projects:
- virtual learning material in the university virtual learning environment (recorded lectures, examples, additional material) /with self-learning 40 hours of student’s time
- activating facilitated workshops, where the iterative innovation process is introduced to the students + introductions to the test laboratory environment + special key-note lectures either in the virtual environment or as participatory lectures in seminars/with self-learning 40 hours of student’s time
- Discussions and participation to web tasks /with self-learning 40 h of student’s time
- Exams and related work/with self-learning 15 h hours of student’s time

Target group:
Students of the Master’s Programs in Biomedical Engineering and Medical & Wellness Technology. The course will also be available as an elective course for medicine, health sciences, information technology and other interested degree programs.

Prerequisites and co-requisites:

Recommended optional programme components:
It is recommended that the student has completed the course 041201A Basics in eHealth.

Recommended or required reading:
Recommended or required reading is offered in Oulu University’s virtual learning environment and in linked web pages. The teachers can recommend additional material in the beginning of the course.

Assessment methods and criteria:
Web tasks, contribution to moderated discussion and workshops, and course exams.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1 – 5 or fail.

Person responsible:
Professor Jarmo Reponen (responsible teacher)
Professor Minna Pikkarainen
Course assistant teacher Anna Maijala MSc

Working life cooperation:
The facilitated workshops are meant to be organized in collaboration with OuluHealth TestLabs and enterprises according to availability.

Other information:

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555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila
A440266: Complementary Module, Software Engineering, 20 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Common studies

811372A: Software Development, Maintenance and Operations, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Mika Mäntylä
Opintokohteen kielet: English
Leikkaavuudet:
  ay811372A Software Development, Maintenance and Operations (OPEN UNI) 5.0 op
  815312A Software Production and Maintenance 5.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
English

Timing:
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st autumn semester of the Master's studies.

Learning outcomes:
After completing the course, the student will able to:
* explain and utilize theories of software evolution,
* utilize the processes, techniques and tools for software deployment, and operations,
* utilize the processes, techniques and tools for software maintenance, as well as
* utilize the processes, techniques and tools to better understand and maintain large code bases.

Contents:
* Software Maintenance and Evolution
* Software Product Lines
* Software Maintenance and Evolution Models
* DevOps
* Reengineering
* Legacy Systems

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures (Video): 20 h, exercises / assignments 78 h, weekly study 42 h

Target group:
MSc students

Prerequisites and co-requisites:
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and programming.

**Recommended or required reading:**
Videos, books, exercises

**Assessment methods and criteria:**
Exercises, assignments

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Mika Mäntylä

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**Software Production**

**811373A: Professional Software Engineering Processes and Human Factors, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Isomursu

**Opintokohteen kielet:** English

**Leikkaavuudet:**
- ay811373A  Professional Software Engineering Processes and Human Factors (OPEN UNI 5.0 op
- 815662S  Software Engineering Management, Measurement and Improvement 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English

**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 1st autumn semester of the Master's studies.

**Learning outcomes:**
After completing the student will be able to:
* recognize and describe software development processes models,
* evaluate and compare their applicability in different contexts,
* take human factors into account in planning and operating in professional software development,
* analyze their own strengths and improvement areas as software engineers to see opportunities for development, as well as
* participate in systematic efforts for improvement in software development organizations.

**Contents:**
Module 1: Software development process models. Theory and cases.
Module 2: Human factors in software development. Recognizing individual and team characteristics, and cultivating personal awareness and development pathways.
Module 3: Software process improvement. Theory and cases.

**Mode of delivery:**
Introduction lecture (not mandatory), online assignments, 2-3 lectures of visiting professionals (not mandatory), seminar (online option)

**Learning activities and teaching methods:**
Individual and group activities.
All materials, assignments and group work will be done online.
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Target group:
MSc students

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Development, Maintenance and Operations.

Recommended or required reading:
Provided in Moodle.

Assessment methods and criteria:
Completing online assignments, active participation in peer feedback

Grading:
Pass or fail

Person responsible:
Minna Isomursu

Working life cooperation:
Visiting lectures of experienced software professionals (2-3)

812331A: Interaction Design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Leena Arhippainen
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work.

Language of instruction:
English

Timing:
The course is not lectured anymore, because it is not part of the new curriculum. However, it can be taken as a self-study course during the academic year 2020-2021. In that case, contact the responsible teacher. Later, if the course is obligatory in your degree programme structure, it must be replaced with another course. In that case, contact your tutor teacher or academic affairs.

Learning outcomes:
After completing the course, the student can assess the role of human interaction with IT products, systems, and services and identify factors and problems related to it within a practical design case. The student is able to: use methods for analysis and evaluation of existing interfaces; understand the role of requirements, plan and conduct a simple requirements collection and analysis; use basic principles of usability and user experience for user interface design; use interaction design methods in designing for target user experiences.

Contents:
The course provides an overview of interaction design, introducing the terminology and fundamental concepts, the main activities, and the importance of user involvement in the design process. The course addresses establishing requirements for IT products, systems, and services. The focus is on usability and user experience from the viewpoint of the intended users, their tasks and the context of use. The course covers user-centered methods for designing for and evaluating usability and user experience of IT products, systems, and services. All the main activities of interaction design are carried out in a practical design case.

Mode of delivery:
Self study
Learning activities and teaching methods:
Self-study: assignments and/or an exam

Target group:
MSc students

Prerequisites and co-requisites:
Basic knowledge on human-computer interaction with usability and user-centered design.

Recommended or required reading:

Assessment methods and criteria:
Accepted assignments.

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Netta livari

521041A: Applied Computing Project I, 8 op

Voimassaolo: 01.08.2018 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Ojala, Timo Kullervo
Opintokohteen kielet: Finnish, English
Leikkaavuudet:
521151A Applied Computing Project I 10.0 op

ECTS Credits:
8 ECTS credits / 216 hours of work

Language of instruction:
Finnish and English

Timing:
The course is held in the spring semester, during periods III and IV. It is recommended to complete the course during the 3rd year.

Learning outcomes:
Upon completion of the course, the student will be able to:
1. has basic understanding on how to collaboratively design a small-scale software project,
2. has basic understanding on how to implement and evaluate a small-scale software project,
3. is able to extensively document a small-scale software project,
4. is able to present and "pitch" a project work, i.e. give a good, concise presentation of the work

Contents:
The basics concepts and practices of implementing a software project in the domain of applied computing

Mode of delivery:
Online teaching, project work in groups

Learning activities and teaching methods:
8 hours of introductory lectures. Majority of the course is guided project work

Target group:
3rd year Computer Science and Engineering B.Sc. students and other Students of the University of Oulu.

Prerequisites and co-requisites:
Elementary Programing (521141P), Human-Computer Interaction (521145A) or corresponding skills
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course uses continuous assessment so that the project work is assessed in stages: design (20% of total grade), implementation (40%), evaluation (20%), and final report (20%). Passing criteria: all stages (design, implementation, evaluation, report) must be completed with an approved grade. Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5; zero stands for a fail.

Person responsible:
Timo Ojala

Working life cooperation:
The projects that the students will undertake are defined either by the research group or industry partners. In the projects defined by the industry, the students will carry out a development project to create a solution for the company’s genuine and existing challenges. The project reports regularly to the project steering group consisting of a supervising teaching assistant as well as the company representative. In addition, the course can have guest lectures from industry regarding collaborative software development and evaluation practices.

Other information:
The 521275A course offers the possibility to complete your Bachelor thesis in a structured course environment. The course is suitable also for students who do not use the course for their Bachelor Thesis.

The course is in Moodle: https://moodle.oulu.fi/course/view.php?id=5086

811602S: Advanced Software Quality and Security, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Alireza Haghighatkhah, Mika Mäntylä
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
English

Timing:
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd autumn semester of the Master's studies.

Learning outcomes:
After completing the course, the student will be able to:
* understand and utilize software quality models,
* understand and utilize some software testing and security techniques, and understand their benefits and limitations, as well as
* apply software testing and security techniques in small scale projects.

Contents:
Testing and quality techniques: Model-based testing, search-based testing, defect prediction, exploratory testing, combinatorial testing, static testing, static analyzers, virtualization, test automation, Security Attacks buffer overflows, command injection; Security testing: vulnerability scanning, intrusion detection.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lecture 16 h, Exercises 24 h

Target group:
MSc students

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Professional Software Engineering Processes and Human Factors.

Recommended or required reading:
Lectures, Slides, Articles

Assessment methods and criteria:
Assignments, Exercises, Essays

Grading:
Numerical scale 1-5 or fail

Person responsible:
Alireza Haghighatkhah

811603S: Software Platforms and Ecosystems, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysksikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juustila, Antti Juhani
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
English

Timing:
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Master's studies.

Learning outcomes:
After completing the course, the student will be able to:
* define what are software platforms and ecosystems,
* understand how software platforms and ecosystems can be used for business,
* analyze the benefits and drawbacks of different platforms or ecosystems, as well as
* operate, use and make contributions to a particular software platform or ecosystem.

Contents:
* Introduction to software platforms and ecosystems
* Business and strategic aspects of platforms and ecosystems
* Development of software systems utilizing platforms or ecosystems
* Benefits and drawbacks of platforms or ecosystems - business and development views
* Case studies, practical project with a selected platform or ecosystem

Mode of delivery:
Learning activities and teaching methods:
Lectures 24 h, exercises or group work 24 h, independent study 52 h, assignments 48 h

Target group:
MSc students

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Advances Software Quality and Security

Recommended or required reading:
Announced in the beginning of the course

Assessment methods and criteria:
Exam, graded project work and reports, graded assignments.

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Antti Juustila

521156S: Towards Data Mining, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Satu Tamminen
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits

Language of instruction:
English

Timing:
Autumn, period I.

Learning outcomes:
After completing this course, student can recognize data types and perform required pre-processing steps before further analysis:
1. Student can design and implement a data collection process
2. Student can combine data from different sources
3. Student can normalize and transform data, and handle missing or incorrect values
4. Student can ensure generalizability of the results

Contents:
Course provides good ability to start Master’s Thesis or graduate studies. Topics at the course include data mining process in general level, data gathering and different data types, quality and reliability of the data, data preparation including the processing of missing values, outliers, and privacy issues, combination of signals from several sources, utilization of data bases in data mining process, and normalization and transformation of data and interdependence of the observations and their distributions. Additionally, topics concerning the generality of the results are covered, as well as, the principles of data division, for example, train-test-validate, cross-validation and leave-one-out methods.

Mode of delivery:
Lectures, independent work, group work

Learning activities and teaching methods:
16 h lectures, 16 h exercises, independent studying.
Target group:
The course is suitable for Master level students in Computer science and engineering study programmes, for minor subject studies or for doctoral students.

Prerequisites and co-requisites:
031021P Probability and Mathematical Statistics or similar

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture hand-out and exercise material will be provided. The course book will be announced in the beginning of the course. The material is mostly in English.

Assessment methods and criteria:
Weekly pre-lecture assignment + exercise submissions, and final exam. Half of the grade will be based on the submissions and half on the final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5; zero stands for a fail.

Person responsible:
Tamminen Satu

Working life cooperation:
-

Other information:
Moodle: https://moodle.oulu.fi/course/view.php?id=1679
Towards Data Mining 521156S:3

811604S: Software for Intelligent Systems and Artificial Intelligence (AI), 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Minna Isomursu
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
English

Timing:
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 2nd spring semester of the Master's studies.

Learning outcomes:
After completing the course, the students will be able to:
* reflect and critically assess the role of AI in software intensive services,
* reflect and discuss issues related to design of software intensive services using AI, as well as
* develop a project using the methods and theory learned throughout the course.

Contents:
The course consists of four main modules. These are:
* Introduction to the course
* Basics of AI in software intensive services
* AI project, the theme will be decided yearly
* theoretical reflective learnings
Mode of delivery:
Introduction lecture, online assignments, final seminar

Learning activities and teaching methods:
Individual online assignments, project work executed in groups, peer feedback in seminar

Target group:
MSc students

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Platforms and Ecosystems

Recommended or required reading:
Provided in Moodle

Assessment methods and criteria:
Online assignments, project work with presentation

Grading:
Pass or fail

Person responsible:
Minna Isomursu

Information systems

813623S: Information Security Policy and Management in Organisations, 5 op

Voimassaolo: 01.08.1950 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Nataliya Shevchuk
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work.

Language of instruction:
English

Timing:
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 2nd spring semester of the Master's studies.

Learning outcomes:
After completing the course, the student will be able to:
* develop BCM (Business Continuity Management) and SA (Systems Availability) strategy;
* develop organization specific information security policies in organizations;
* conduct Information Security (and risk) Analysis;
* conduct Information Security Audits;
* understand information security standards, regulations, and policies;
* improve employees' compliance with the information security procedures through training, campaigning and other means;
* describe certifications related to information security (such as ISO27001); as well as
* describe public-key infrastructure (PKI), Digital signature, & Certification authority (CA).

Contents:
* Business Continuity Management (BCM) and Systems Availability (SA)
* Information Security Life Cycle
* Conduct Information Security (and risk) Analysis;
* Information security standards, regulations, and policies
* Information security investment management
* Insider threats in information security management
* Security Audits (Active Security Assessment)
* Information Security Certification (ISO27001) & Certification authority (CA)

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures (24 h), exercises (23 h), learning diary (30 h), essay (20 h), examination (36 h)

Target group:
MSc students

Prerequisites and co-requisites:
Understanding of information security issues, principles, techniques, or similar knowledge, is helpful.

Recommended or required reading:
Research articles to be announced more specifically during the course implementation.

Assessment methods and criteria:
Examination.

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Nataliya Shevchuk

521453A: Operating Systems, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Röning
Opintokohteen kielet: English
Leikkaavuudet:
  ay521453A  Operating Systems (OPEN UNI)  5.0 op

ECTS Credits:
5

Language of instruction:
In Finnish, material available in English

Timing:
Spring, period 4

Learning outcomes:
1. is capable of explaining the basic structure and functioning of operating system
2. is able to point the problems related to process management and synchronization as well as is able to apply learned methods to solve basic problems
3. is capable of explaining the cause and effect related to deadlocks and is able to analyse them related to common circumstances in operating systems
4. is able to explain the basics of memory management, the use of virtual memory in modern operating systems as well as the structure of the most common file-systems.

Contents:
Operating system structure and services, process management, process synchronization, deadlocks, memory management, virtual memory, file-systems
Mode of delivery:
Face-to-face.

Learning activities and teaching methods:
Lectures 36 h, laboratory exercise 4 h, the rest as independent work. The laboratory work, including pre-exercise and guided exercise performed in a group of one or two students in the unix environment, covers core topics of the course.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
521141P Elementary Programming, 521286A Computer Systems or 521142A Embedded Systems Programming and 521267A Computer Engineering

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course is passed the final examination and accepted laboratory working.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Juha Röning (lectures)
Anna-Mari Wartiainen (exercises)

Working life cooperation:
-

Other information:
-

811312A: Data Structures and Algorithms, 5 op

Voimassaolo: 01.08.2010 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juustila, Antti Juhani
Opintokohteen kielet: Finnish
Leikkaavuudet:

521144A Algorithms and Data Structures 6.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work.

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Bachelor's studies.

Learning outcomes:
After completing the course the student will be able to:
* select data structures and algorithms to an application,
* apply induction when proving algorithm correctness and define recursive algorithms,
* describe trees, graphs and their basic algorithms and apply them in a program,
* describe the most common sorting algorithms, as well as
* analyse the correctness and time complexity of an algorithm implemented in a program.

**Contents:**
* Basic data structures
* Analysis of algorithms
* Sorting algorithms
* Hash tables
* Binary search trees
* Graphs and their algorithms
* Algorithm design paradigms

**Mode of delivery:**
Face-to-face teaching.

**Learning activities and teaching methods:**
Lectures 48 h, exercises 21 h, exercise work 27 h, independent study 39 h.

**Target group:**
BSc students.

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished:
Databases

**Recommended optional programme components:**

**Recommended or required reading:**
Cormen, Leiserson, Rivest, Stein: Introduction to algorithms, Second edition, MIT Press 2001 (or newer)
and other material defined during the course.

**Assessment methods and criteria:**
1. Exam and assignment OR 2. Mid-term exams (2) and assignment

**Grading:**
Numerical scale 1-5 or fail.

**Person responsible:**
Antti Juustila

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**555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish
**Voidaan suorittaa useasti:** Kyllä

**Person responsible:**
University lecturer Osmo Kauppila

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**A440267: Complementary Module, Information Engineering, 20 - 30 op**
Artificial Intelligence

521156S: Towards Data Mining, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Satu Tamminen
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits

Language of instruction:
English

Timing:
Autumn, period I.

Learning outcomes:
After completing this course, student can recognize data types and perform required pre-processing steps before further analysis:
1. Student can design and implement a data collection process
2. Student can combine data from different sources
3. Student can normalize and transform data, and handle missing or incorrect values
4. Student can ensure generalizability of the results

Contents:
Course provides good ability to start Master’s Thesis or graduate studies. Topics at the course include data mining process in general level, data gathering and different data types, quality and reliability of the data, data preparation including the processing of missing values, outliers, and privacy issues, combination of signals from several sources, utilization of data bases in data mining process, and normalization and transformation of data and interdependence of the observations and their distributions. Additionally, topics concerning the generality of the results are covered, as well as, the principles of data division, for example, train-test-validate, cross-validation and leave-one-out methods.

Mode of delivery:
Lectures, independent work, group work

Learning activities and teaching methods:
16 h lectures, 16 h exercises, independent studying.

Target group:
The course is suitable for Master level students in Computer science and engineering study programmes, for minor subject studies or for doctoral students.

Prerequisites and co-requisites:
031021P Probability and Mathematical Statistics or similar

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Lecture hand-out and exercise material will be provided. The course book will be announced in the beginning of the course. The material is mostly in English.

Assessment methods and criteria:
Weekly pre-lecture assignment + exercise submissions, and final exam. Half of the grade will be based on the submissions and half on the final exam. Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5; zero stands for a fail.

Person responsible:
Tamminen Satu

Working life cooperation:

Other information:
Moodle: https://moodle.oulu.fi/course/view.php?id=1679
Towards Data Mining 521156S:3

521289S: Machine Learning, 5 op

Voimassaolo: 01.08.2015 -
Opiskelmuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Seppänen
Opintokohteen kielet: Finnish
Leikkaavuudet:

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<td>Pattern Recognition and Neural Networks; Exercise Work</td>
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ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
The course unit is held in the spring semester, during period III. It is recommended to complete the course at the end of studies.

Learning outcomes:
After completing the course, student
1. can design simple optimal classifiers from the basic theory and assess their performance.
2. can explain the Bayesian decision theory and apply it to derive minimum error classifiers and minimum cost classifiers.
3. can apply regression techniques to practical machine learning problems.

Contents:

Mode of delivery:
Online teaching, guided laboratory work and independent assignment. The laboratory works are done on an online system (Mathworks Grader). Student can do the lab works remotely or in the lab using the same online system.
The course is implemented as remote education via the Moodle work space [https://moodle.oulu.fi/course/view.php?id=5729](https://moodle.oulu.fi/course/view.php?id=5729)

This work space opens to students before the course begins. The student must register to the course in WebOodi in order to participate the course.

**Learning activities and teaching methods:**
Lectures 16 h, Laboratory work 16 h, and Self-study the rest (Independent task assignment).

**Target group:**
Students who are interested in machine learning and pattern recognition theory and methods.

**Prerequisites and co-requisites:**
The mathematic studies of the candidate degree program of computer science and engineering, or equivalent. Programming skills, especially basics of the Matlab.

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Will be informed when the course starts.

**Assessment methods and criteria:**
Laboratory work is supervised by assistants who also verify that the task assignments are completed properly. The Matworks Grader online system also verifies the completed tasks. The independent task assignment is graded which establishes the grade for the course.

Read more about [assessment criteria](https://moodle.oulu.fi/course/view.php?id=5729) at the University of Oulu webpage.

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. The final grade is established by the independent task assignment.

**Person responsible:**
Tapio Seppänen

**Working life cooperation:**
No

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**521283S: Big Data Processing and Applications, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Computer Science and Engineering DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lauri Lovén

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits

**Language of instruction:**
English

**Timing:**
Period IV. It is recommended that the course is taken on the fourth year Spring.

**Learning outcomes:**
Upon completion of the course, the student:
1. is able to explain the big data phenomenon, its challenges and opportunities.
2. is able to explain the requirements and common principles for data intensive systems design and implementation, and evaluate the benefits, risks and restrictions of available solutions.
3. can explain the principles of big data management and processing technologies and utilize them on a basic level.

**Contents:**

General introduction into big data, namely: big data fundamentals, data storage, batch and stream data processing, data analysis, privacy and security, big data use cases.

**Mode of delivery:**
Online teaching, exercises and seminars. Independent and group work.

**Learning activities and teaching methods:**
Lectures, exercises, seminars, independent and group work

**Target group:**
M.Sc. students (computer science and engineering) and other Students of the University of Oulu

**Prerequisites and co-requisites:**
The Bachelor level studies of Computer science and engineering study programmes or respective knowledge.

**Recommended optional programme components:**

**Recommended or required reading:**
Lecture slides and exercise material will be provided. Each lecture will include the refernce list for recommended reading. Instructions to necessary installations will be given.

**Assessment methods and criteria:**
This course assesses students continuously by the completion of small project work, seminar presentations and short reports on a selected topic (group work). Answering two quizzes during the course is optional and provides additional points for final grade. To pass the course, it is enough to get 50 % of available points. No exam.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Lauri Lovén

**Working life cooperation:**
The course includes also invited lectures from industry.

**Other information:**
Course is in Moodle.

**811168P: Information Security, 5 op**

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuysikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tero Päivärinta

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay811168P Information Security (OPEN UNI) 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work.

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester of the Bachelor's studies.
Learning outcomes:
After completing the course, the student will be able to:
* define essential information security concepts and components of information systems security,
* recognize the common types of security threats, and their managerial and technical protection mechanisms,
* describe the tasks and responsibilities of information security professionals,
* explain the different phases of secure systems development/acquisition,
* recognize the fundamental characteristics of risk management and evaluate information security risks,
* recognize basics of technical information security methods and cryptography, as well as
* explain areas of behavioral information security research and their practical implications.

Contents:
* Basic concepts of information security
* Information security threats, vulnerabilities, and risks
* Legal issues and information security frameworks
* Risk management
* Cryptography
* Information security technologies
* Behavioral information security research

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures and related quizzes or final exam 26 h, weekly assignments and scientific essay 107 h

Target group:
BSc students.

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses are accomplished:
Introduction to Information Processing Science as well as Devices and Data Network

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
Weekly assignments. Group or individual assignment.

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Tero Päivärinta

Computer Science

521453A: Operating Systems, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Röning
Opintokohteen kiele: English
Leikkaavuudet:

ay521453A Operating Systems (OPEN UNI) 5.0 op

ECTS Credits:
5
Language of instruction:
In Finnish, material available in English

Timing:
Spring, period 4

Learning outcomes:
1. is capable of explaining the basic structure and functioning of operating system
2. is able to point the problems related to process management and synchronization as well as is able to apply learned methods to solve basic problems
3. is capable of explaining the cause and effect related to deadlocks and is able to analyse them related to common circumstances in operating systems
4. is able to explain the basics of memory management, the use of virtual memory in modern operating systems as well as the structure of the most common file-systems.

Contents:
Operating system structure and services, process management, process synchronization, deadlocks, memory management, virtual memory, file-systems

Mode of delivery:
Face-to-face.

Learning activities and teaching methods:
Lectures 36 h, laboratory exercise 4 h, the rest as independent work. The laboratory work, including pre-exercise and guided exercise performed in a group of one or two students in the unix environment, covers core topics of the course.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
521141P Elementary Programming, 521286A Computer Systems or 521142A Embedded Systems Programming and 521267A Computer Engineering

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course is passed the final examination and accepted laboratory working.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Juha Röning (lectures)
Anna-Mari Wartiainen (exercises)

Working life cooperation:
-

Other information:
-

031023P: Mathematical Structures for Computer Science, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Matti Peltola
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay031023P Mathematical Structures for Computer Science (OPEN UNI) 5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn, during period 1. It is recommended to complete the course at the 2nd autumn semester.

Learning outcomes:
The student is able to apply result of logic to find the truth value of logical statement and can express sentences of natural language by symbols of logic. He/She can use arithmetic operations on different number bases. The student recognize the main types of graphs and understand the basis concepts of graphs and is able to apply formal methods of discrete mathematics to model simple information processing problems.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h / Group work 14 h / Self-study 93 h.

Target group:
2. year students of computer science.

Prerequisites and co-requisites:
No prerequisites

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The course can be completed by intermediate exams (2 exams) or by a final exam. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail

Person responsible:
Matti Peltola

Working life cooperation:
-

521286A: Computer Systems, 8 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course


**Vastuuysikkö:** Computer Science and Engineering DP  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Teemu Leppänen  
**Opintokohteen kielet:** Finnish  
**Leikkaavuudet:**  
521142A Embedded Systems Programming 5.0 op  

**ECTS Credits:**  
8 ECTS cr  

**Language of instruction:**  
Lecturing in Finnish, course and exercise material available in English.  

**Timing:**  
Autumn, periods 1-2.  

**Learning outcomes:**  
Upon completion of the course:  
Student understands the basic computer architecture and organization.  
Student understands CPU operation and basic datapath operation.  
Student knows different number systems and data representations in computers.  
Student is familiar of I/O operation with peripheral devices in general.  
Student is able to implement small programs with the C programming language for general-purpose computers for embedded systems.  
Student is able to implement small assembly language programs.  
Student recognizes how embedded systems programming is different from programming general-purpose computers.  

**Contents:**  
Overview of computer architecture and organization, CPU and datapath, memory hierarchies, data types, interrupts, registers and I/O, basics of the C programming language and basics of assembly language.  
Embedded systems programming.  

**Mode of delivery:**  
Web-based teaching + face-to-face teaching.  

**Learning activities and teaching methods:**  
Lectures (32h), course exercises (10-30h), laboratory exercise (3h) and two course projects, one is completed in a group and the other alone.  

**Target group:**  
2nd year students of computer science and engineering and 3rd year students of Electronics and Communications Engineering.  

**Prerequisites and co-requisites:**  
Elementary programming 521141P.  

**Recommended optional programme components:**  
The course is an independent entity and does not require additional studies carried out at the same time.  

**Recommended or required reading:**  
Lecture notes and exercise material are available in the course website.  
Literature:  

**Assessment methods and criteria:**
The assessment criteria is based on the learning outcomes of the course. Students complete the course exercises, participate to the laboratory exercise and complete the course projects. Assessment is based on the exercises and the course projects. More detailed information on assessment is published in the lecture material.

**Grading:**
Numerical grading scale 1-5, zero stands for fail.

**Person responsible:**
Teemu Leppänen

**Working life cooperation:**
Visiting lectures with experts from local industry are possible.

**Other information:**
The course learning platform is Lovelace (lovelace.oulu.fi).

521043S: Internet of Things, 5 op

**Voimassaolo:** 01.08.2018 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Computer Science and Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Ella Peltonen
**Opintokohteen kielet:** English

**Proficiency level:**

**Status:**

**ECTS Credits:**
5 ECTS / 135 hours of work

**Language of instruction:**
English

**Timing:**
Autumn semester during period 2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
1. explain application areas of IoT and requirements from such application areas for IoT systems.
2. will be able to explain the state-of-the-art IoT solutions, and understand the basic technologies behind them.
3. learn the principles of the novel IoT technologies and know important directions IoT research towards.

**Contents:**
The basic technologies and novel applications of the Internet of Things, including networking technologies as well as Web of Things. IoT sensor technologies and sensing solutions for smart buildings including smart home, city, office, or campus environments, and wearables and other personal devices such as fabrication. Exercises will include hands-on programming and sensing data analytics tasks.

**Mode of delivery:**
The course will be given fully remotely. Please join the Moodle page (https://moodle.oulu.fi/course/view.php?id=5330, password is iot2020) and attend the introduction Zoom lectures in Tue 27.10. 10:15-12 (for general organisation) and Wed 28.10. 14:15-16 (for course project).

**Learning activities and teaching methods:**
20h lectures, 12h exercise sessions, independent studying 95 hours.

**Target group:**
M.Sc. students of Computer Science and Engineering, M. Sc. students of Ubicomp International master program. The course fits also for Statistics and Math MSc student interested in applying their knowledge into sensing and IoT data.

**Prerequisites and co-requisites:**
The Bachelor level knowledge of Computer science and engineering study programmes. Good programming skills in a chosen language.

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Lecture hand-out, complementary reading list, and exercise material will be provided.

**Assessment methods and criteria:**
Attending lectures and exercise sessions, and returning the weekly exercises online. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Ella Peltonen
Working life cooperation:
The course may include the invited guest lectures from industry and other top EU universities.

Other information:
Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi.

521348S: Statistical Signal Processing 1, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juntti, Markku Johannes, Janne Lehtomäki
Opintokohteen kielet: Finnish
Leikkaavuudet:
   521484A Statistical Signal Processing 5.0 op

ECTS Credits:
5 ECTS

Language of instruction:
English

Timing:
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st semester of the master studies.

Learning outcomes:
Upon completion the student
1. knows the key tools of linear algebra and quadratic optimization and can apply them in solving signal processing problems.
2. understands how to handle complex valued random variables and processes.
3. understands the key concepts in estimation theory such as the classical and Bayesian philosophies.
4. masters the most important estimation principles such as minimum variance, maximum likelihood, least squares and minimum mean square error estimators.
5. can derive an estimator for a given criterion and basic data models.
6. can use the methodology of estimation theory to analyze the performance of estimators and compare to performance benchmarks such as the Cramer-Rao lower bound.
7. understands the basics of detection and classification theory: hypothesis testing, receiver operating characteristics (ROC), the Neyman-Pearson and Bayesian detectors.

Contents:
Review of probability, complex valued random variables and stochastic processes; linear algebra, eigenvalue decomposition, SVD (Singular value decomposition), use of Matlab; estimation theory, minimum variance unbiased estimator, Cramer-Rao lower bound, linear models, general minimum variance unbiased estimation, best linear unbiased estimators, maximum likelihood estimation, least squares estimation, Bayesian estimation, linear Bayesian estimation; statistical decision theory, receiver operating characteristics, hypothesis testing, matched filter.

Mode of delivery:
Face-to-face teaching and e-learning tool usage
Learning activities and teaching methods:
Face-to-face-teaching (lectures and exercises) 50h, Matlab simulation exercises in groups 30 h, independent work & passed assignment 50 h.

Target group:
Electrical, communications and computer science and engineering students.

Prerequisites and co-requisites:
The required prerequisite is the completion of the following courses prior to enrolling for the course: 031080A Signal Analysis, 031021P Probability and Mathematical Statistics, 031078P Matrix Algebra, 521330A. The recommended prerequisite is the completion of Telecommunication Engineering.

Recommended optional programme components:
521323S Wireless communications I and 031051S Numerical Matrix Analysis are recommended to be taken in parallel.

Recommended or required reading:
Parts from books:
5. Other literature, lecture notes and material.

Assessment methods and criteria:
Completing the simulation project tasks, and a mid-term exam during the course. The mid-term exams can be retaken by a final exam later. In the final grade of the course, the weight for the examination is 0.7 and that of project report 0.3.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero (0) stands for a fail.

Person responsible:
Janne Lehtomäki and Markku Juntti

Working life cooperation:
No

Other information:
Lecture materials etc. can be found on Moodle https://moodle.oulu.fi/course/view.php?id=4203.

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettaja: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

A440264: Complementary Module, Mining Technology and Mineral Processing, 20 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Supplementary Module
Electives

493300A: Principles of mineral processing, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Saija Luukkanen
Opintokohteen kielet: English, Finnish
Leikkaavuudet:
  ay493300A Principles of mineral processing (OPEN UNI) 5.0 op

ECTS Credits:
5 ECTS / 133 hours of work
Language of instruction:
Finnish; material mainly in English
Timing:
2nd period in the autumn. Recommended for the 3rd year students.
Learning outcomes:
Upon completion the course the student can explain the main unit process used in ore beneficiation and understands the main chemical and mineralogical factors palying the key role in process development. The student is able to calculate the most relevant process related calculations, such as mass balances, concentrate recoveris and grindability. The student is aware of the environmental as well as H&S aspects of mineral processing.

Contents:
The main unit processes used in mineral processing. Understanding how the mineralogy and chemistry of the ore influences in the process development.

Mode of delivery:
Mainly face-to-face teaching
Learning activities and teaching methods:
Lectures, demonstrations, assignments
Target group:
Student with mineral processing as major; students of mining engineering, geosciences and process engineering
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
The material provided during the course. B.A. Wills: Mineral processing technology
Assessment methods and criteria:
Final exam, home works and practicals, energy
Grading:
1-5/fail

Person responsible:
Saija Luukkanen

Working life cooperation:
No

Other information:
-

493302A: Chemical phenomena in mineral processes, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Saija Luukkanen
Opintokohteen kiele: Finnish

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
Finnish, course material in English

Timing:
The course is held in the autumn semester, during period 2. It is recommended to complete the course at the 3rd study year

Learning outcomes:
Upon successful completion student can explain physical-chemical phenomena (especially surface and electro chemical) affecting various unit operations in mineral processing. Student can also describe general phases in mineral processing and unit operation from standpoint of physical chemistry.

Contents:
Reaction equilibria, basic equations in thermodynamics; chemical interactions especially at interfaces; electrochemical interactions, effects of chemical phenomena on the unit operations of mineral processing.

Mode of delivery:
Face to face teaching

Learning activities and teaching methods:
32 h lectures and exercises (homework)

Target group:
Students in mining engineering and mineral processing, geosciences or process engineering

Prerequisites and co-requisites:
493300A Principles of Mineral Processing

Recommended or required reading:
Lectures and electronic materials

Assessment methods and criteria:
Final exam, homework exercises, activity

Grading:
1-5/fail

Person responsible:
Prof. Saija Luukkanen, lecturer Docent Jaakko Leppinen

772335A: Introduction to ore mineralogy, 5 op
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Eero Hanski
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS

Language of instruction:
The language of instruction is English.

Timing:
The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd or 3rd autumn semester.

Learning outcomes:
Upon completion of this course, the student will:
- obtain basic knowledge on ore minerals and their mode of occurrence
- learn to recognise the most common ore minerals and textures under the ore microscope.

Contents:
Division and structure of ore minerals, composition and texture, phase diagrams and their applications. Ore microscope and how it is used, microscopic properties of ore minerals. Identification of ore minerals and ore mineral assemblages.

Mode of delivery:
Face to face teaching.

Learning activities and teaching methods:
14 h lectures, 21 h exercises.

Target group:
All students in geosciences and mining engineering and mineral processing.

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: 771102P Basic mineralogy, 772339A Optical mineralogy.

Recommended optional programme components:
The course in an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
The availability of the textbooks can be checked via this link.

Assessment methods and criteria:
Examinations in both theory and calculations.

Grading:
In the theory exam grade and final grade, the course utilizes a numerical grading scale of 1-5. Zero stands for a fail. In the microscope exam, the course utilizes verbal grading pass/fail.

Person responsible:
Shenghong Yang
Working life cooperation:
No.

493605S: Ore benefication technologies, 5 op

Voimassaolo: 01.08.2016
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English, Finnish

ECTS Credits:
5 ECTS cr /133 hours of work

Language of instruction:
English

Timing:
Autumn semester, period 1. It is recommended to complete the course at the 1st autumn semester of the Master's studies.

Learning outcomes:
Upon completion of the course students should be able to:
- Describe the principles and applications of the main beneficiation technologies
- Recognize the variables affecting the selection of the process techniques
- Understand the characteristics of the feed material and behaviour during physical and chemical beneficiation processes (commination, flotation, gravity separation and sedimentation processes) and characteristics of the products and waste
- Understand of optimization methods applied in beneficiation plants
- Apply knowledge in practical exercises, carrying out calculation of sample size, efficiencies, balances and basic design of the unit operations that are used in ore processing

Contents:
Module 1: Introduction to Mineral Processing Technology
Module 2: Mineral Characterization Techniques
Module 3: Commination - Size reduction
Module 4: Beneficiation Technologies - Physical Separation Techniques
Module 5: Physic-chemical separation techniques
Module 6: Solid-Liquid Separation
Module 7: Cu, Fe, Phosphate beneficiation and Optimization in separation processes
Module 8: Seminar (technic, method or process reviewed)
Additionally, it is included Practices in sampling, comminution, flotation, mass balances, lab test calculation (in laboratory or on-line according to the situation)

Mode of delivery:
Classroom education and on-line, practice in laboratory

Learning activities and teaching methods:
Lectures 24h / Practice 16h / Group work 12h / Self-study includes exercises and assignments 75h

Target group:
Students in the study option MEMP Mineral processing, minor subject and other students of the Oulu Mining School and Faculty of Technology

Prerequisites and co-requisites:
493300A Principles in Mineral Processing, 493302A Chemical Phenomena in Mineral processing for Finnish students
Previous courses in Mineral Processing for international students

Recommended optional programme components:
The course is an independent entity and does not require additional studies out at the same time. Review of the material and reading is recommended.
Recommended or required reading:

Assessment methods and criteria:
Continuous assessment during lectures, exercises (participation), reports, papers review, questionary self-learning, quizzes
The final assessment method: Seminar peer review and Assignment
Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture and attendance is very important

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Maria Sinche Gonzalez

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

A440255: Supplementary Module, Mechanical Engineering, 20 - 30 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Common courses

462107A: Maintenance of machines, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouni Laurila
Opintokohteen kielet: Finnish
Leikkaavuudet:
ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 3rd spring semester.

Learning outcomes:
After completing the course, the student will be familiar with the principles and most common methods of implementing fitness based maintenance. They are able to explain the importance of running in production and apply the most important standards in the field of maintenance. different types of maintenance and can tell you what aspects of choosing a maintenance strategy. The student knows how to name the most common machine failure methods and the consequences of failure and can tell how to prevent failure in typical situations. The student recognizes the effects of wear and lubrication on the condition of machines and is able to explain the basic concepts related to lubricant analysis. The student knows how to use the most common methods used in machine condition monitoring and how to use them. He / she can explain the basics of vibration measurements and can choose appropriate measurement and analysis methods to identify the most common machine failures. The student knows the importance of running in production and is able to apply the most important standards in the field of maintenance.

Contents:
Condition based maintenance, failure, wear and lubrication, common condition monitoring methods, basics of performing vibration measurements, analyzing and signal processing, common rotating machine failure detection, vibration intensity estimation, rotor dynamic balancing, machine design and condition management. failure, wear and lubrication, machine condition monitoring basics and common methods.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 24 h / group work 50 h / self-study 61 h

Target group:
Bachelor's degree students in the mechanical engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following course: 462103A Introduction to Maintenance

Recommended optional programme components:
The course is an independent entity

Recommended or required reading:

Assessment methods and criteria:
Final examination and the other graded assignments

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jouni Laurila
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Toni Mikael
Opintokohteen kielet: Finnish
Leikkaavuudet:
   462055S-01 Virtual Engineering of Mechatronic Products, examination   0.0 op
   462055S-02 Virtual Engineering of Mechatronic Products, exercise work  0.0 op
   462055S Virtual Engineering of Mechatronic Products                 5.0 op

ECTS Credits:
8 cr / 213 hours of work

Language of instruction: Finnish

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 4th spring semester.

Learning outcomes:
Upon completion of the course, the student will be able to create a simulation model consisting of rigid bodies using Adams and MATLAB/Simulink software. The student is able to interpret the simulation results and is also able to evaluate the validity of the results. The student is able to design submodels of complex systems and he/she is able to explain the principles of creating a more complex simulation model. In addition to this, the student is able to evaluate the extent of modelling process of various kinds of engineering systems.

Contents:
Basics of virtual design; ADAMS simulation software principles and basic usage; Creation and usage of multibody systems comprised of rigid bodies; Kinematic and dynamic analysis; Determination of actuator motion paths and velocities as well as determination of loads; Modelling and simulation of control systems.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 32 h / Group work 32 h / Self-study 149 h

Target group:
Master's degree students of mechanical engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture handout. Other material is in the beginning of the course.

Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, exercises, seminars and exam. The more detailed assessment criteria are available on the Noppa Study Portal.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Lecturer Toni Liedes

521043S: Internet of Things, 5 op
Voimassaolo: 01.08.2018 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Ella Peltonen
Opintokohteen kielet: English

Proficiency level:

Status:

ECTS Credits:
5 ECTS / 135 hours of work

Language of instruction:
English

Timing:
Autumn semester during period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
1. explain application areas of IoT and requirements from such application areas for IoT systems.
2. will be able to explain the state-of-the-art IoT solutions, and understand the basic technologies behind them.
3. learn the principles of the novel IoT technologies and know important directions IoT research towards.

Contents:
The basic technologies and novel applications of the Internet of Things, including networking technologies as well as Web of Things. IoT sensor technologies and sensing solutions for smart buildings including smart home, city, office, or campus environments, and wearables and other personal devices such as fabrication. Exercises will include hands-on programming and sensing data analytics tasks.

Mode of delivery:
The course will be given fully remotely. Please join the Moodle page (https://moodle.oulu.fi/course/view.php?id=5330, password is iot2020) and attend the introduction Zoom lectures in Tue 27.10. 10:15-12 (for general organisation) and Wed 28.10. 14:15-16 (for course project).

Learning activities and teaching methods:
20h lectures, 12h exercise sessions, independent studying 95 hours.
Target group:
M.Sc. students of Computer Science and Engineering, M. Sc. students of Ubicomp International master program. The course fits also for Statistics and Math MSc student interested in applying their knowledge into sensing and IoT data.

Prerequisites and co-requisites:
The Bachelor level knowledge of Computer science and engineering study programmes. Good programming skills in a chosen language.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture hand-out, complementary reading list, and exercise material will be provided.

Assessment methods and criteria:
Attending lectures and exercise sessions, and returning the weekly exercises online. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Ella Peltonen

Working life cooperation:
The course may include the invited guest lectures from industry and other top EU universities.

Other information:
Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi.
462103A: Introduction to Maintenance, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouni Laurila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  464087A-01 Maintenancy Technology, examination  0.0 op
  464087A-02 Maintenancy Technology, exercise work  0.0 op
  464087A Maintenancy Technology  5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

Learning outcomes:
After completing the course, students will be able to explain key concepts related to the maintenance industry, define what maintenance is, and describe its most important impacts on productivity, safety and the environment. The student will be able to name the levels of maintenance activities and describe what aspects are involved in choosing a maintenance strategy. After the course the student is able to calculate the most important reliability indicators and evaluate the overall efficiency of production equipment and the factors affecting it. and classify maintenance activities as corrective and preventive. The student is able to explain what issues and practices are essential for keeping the production assets in good condition. The student can also take into account maintenance related issues in different planning tasks.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
More detailed performance methods are given at the start of the course.

Target group:
Bachelor's degree students in the mechanical engineering

Recommended optional programme components:
The course is an independent entity.

Recommended or required reading:
Lecture handout and the other material delivered during the course. Supplementary readings: Järviö, J., Kunnossapito. Helsinki, KP-Media Oy / 2012.

Assessment methods and criteria:
Final examination and the other graded assignments

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jouni Laurila.
**462101A: Information technology and machines, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Mechanical Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Liedes, Toni Mikael
**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 cr / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2nd spring semester.

**Learning outcomes:**
Upon completion of the course, the student will be able to explain how the information technology is utilized in modern machines. The student is able to describe how the modern machines are developed from purely mechanical systems to multi-disciplinary systems. The student is able to sort out the electrical, information technological and mechanical features of modern machines. He/she is also able to describe the interaction and interfaces of the aforementioned features. In addition to this, the student is able to separate the digital and analog domains. The student is able to create a simple computer program for machine control. He/she is able to name the sensors and actuators being used in automated machines. Furthermore, the student is able to list examples of machines taking advantage of modern information technology.

**Contents:**
History of mechanical engineering and information technology; Information technology as an enabler of the development of machines; Requirements and boundary conditions for automatisation of machines; Concepts of information technology and electronics; Basics of programming and logical reasoning; Examples of machine applications taking advantage of modern information technology.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures 20 h / Group work 12 h / Self-study 101 h

**Target group:**
Bachelor's degree students of mechanical engineering

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Lecture notes. Other material is in the beginning of the course.

**Assessment methods and criteria:**
This course utilizes continuous assessment. During the course there are exercises and intermediate exams. The exercises and the exams will be assessed. The assessment of the course is based on the learning outcomes of the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Lecturer Toni Liedes

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**462102A: Machine automation actuators, 5 op**

**Voimassaolo:** 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Louhisalmi, Yrjö Aulis
Opintokohteen kielet: Finnish

Leikkaavuudet:

- 462021A-01 Machine Automation I, examination 0.0 op
- 462021A-02 Machine Automation I, exercise work 0.0 op
- 462021A Machine Automation I 5.0 op
- 464064A Actuators 5.0 op

ECTS Credits:
5 cr / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 3 and 4. It is recommended to complete the course at the 2nd spring semester.

Learning outcomes:
After completing the course the student can explain the role of actuators in machine automation systems. The student recognizes different types of actuators and can categorize them eg. based on performance and usage limitations. The student is able to design a simple actuator operation and is able to select suitable actuators for a typical automation application. In addition, the student is able to evaluate the sensing needs and operating conditions of actuators as part of the automation system.

Contents:
Basics actuators; Basics of hydraulics, Pneumatics and electrical drives; Performance and efficiency of actuators; Hydraulic actuators; Pneumatic actuators; Electrical actuators.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 32 h / Group work 16 h / Self-study 85 h

Target group:
Bachelor's degree students of mechanical engineering

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture materials. Other material is in the beginning of the course.

Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, homework, exercises, seminars and exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Yrjö Louhisalmi

464105S: Computer aided design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Leikkaavuudet:

- 462044S-01 Computer Aided Design, examination 0.0 op
- 462044S-02 Computer Aided Design, exercise work 0.0 op
- 462044S Computer Aided Design 3.5 op

ECTS Credits:
5 ects / 133 hours of studying work.

Language of instruction:
Finnish, can be completed in English as a book examination.

Timing:
Lectures and exercises arranged spring during periods 3. Recommended date of performance 4th year spring.

Learning outcomes:
After completing the course, the student will know modern CAD/CAE tools, simulation and virtual validation possibilities with CAD/CAE systems. The best procedures in various design tasks have also become familiar. In addition, the student is familiar with the theory behind CAD systems related to the geometry of models and their modification. In addition, the student also has a basis for product information management and the use of design data in PDM/PLM systems.

Contents:
The course includes product design and product validation on a computer-aided basis. During the course, you will get acquainted with the possibilities of product design and validation of functionality using CAD/CAE systems. Use of the computer in design functions and the applicable systems. Parametricity and customizability of the product play an important role. In addition, students learn what special tools design software offers.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 20 h / exercises 30 h / practical assignment 83 h. Exercises are carried out independently and the assignment in small groups.

Target group:
Master's Degree student of mechanical engineering, specially students studying Machine Design.

Prerequisites and co-requisites:

Recommended optional programme components:
The course is an independent entity and does not require other studies to be completed at the same time.

Recommended or required reading:

Assessment methods and criteria:
Final exam, lecture exercises and exercise work. For the final grade, the exam has a weight factor of 0.4; for lecture exercises, 0.2; and for exercise work, 0.4.

Grading:
Numerical grading scale 1-5 / fail

Person responsible:
Jussi Salakka

462105A: Machine Sensor Technology, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Toni Mikael
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5 cr / 133 hours of work
Language of instruction:
Finnish
Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.
Learning outcomes:
Upon completion of the course, the student will be able identify, classify and bring into use the most common sensor types used in machine automation. The student is able to choose sensors for typical automation applications. In addition to this, the student is able to design a common analog and digital signal transmission and conditioning chain.
Contents:
Basics measuring systems; Classification of sensors; Characteristics of analog and digital domain; Analog to digital conversion; Basics of analog signal conditioning: amplification, attenuation and filtering; Operating principle of digital sensors; Examples of typical sensors used in mechanical engineering and civil engineering;
Mode of delivery:
Blended teaching
Learning activities and teaching methods:
Lectures 32 h / Group work 16 h / Self-study 85 h
Target group:
Bachelor's degree students of mechanical engineering
Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: Actuators in Machine Automation
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, exercises, seminars and exam.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Lecturer Toni Liedes
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouni Laurila
Opintokohteen kielet: Finnish
Leikkaavuudet:
- 464088S Diagnosis of Machine Condition 8.0 op
- 464088S-01 Diagnosis of Machine Condition, examination 0.0 op
- 464088S-02 Diagnosis of Machine Condition, exercises 0.0 op

ECTS Credits:
10 ECTS credits / 270 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 4th spring semester.

Learning outcomes:
After completing the course the student will be able to use various methods of machine diagnostics and use the most common measuring devices to determine the functioning and condition of machines. He / she is able to apply the key indicators and signal processing methods used in condition monitoring and to analyze the frequency content of signals in order to solve problems related to the operation of machines. They will be able to draw up a measurement plan, make measurements, analyze the data obtained and report the results obtained. He / she is also able to evaluate what factors affect the reliability and comparability of measurements. The student is able to use industry standards to help evaluate the condition of machinery and the vibration intensity. They will be able to understand the importance of machine diagnostics in the success and productivity of maintenance.

Contents:
Major methods and measurement techniques used in machine diagnostics, machine vibration analysis and fault detection, key signal processing methods, measurement design, implementation and reporting, machine balancing, industry standards.

Mode of delivery:
Face-to-face teaching

Target group:
Master's degree students in the mechanical engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following course: 462107A Maintenance of Machines, 462105A Sensor technology for Machines.

Recommended optional programme components:
The course is an independent entity.

Recommended or required reading:

Assessment methods and criteria:
Final examination and the other graded assignments

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jouni Laurila
Introduction to Electronics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Jari Hannu
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay521077P   Introduction to Electronics (OPEN UNI)   5.0 op
  521209A   Electronics Components and Materials   2.0 op

ECTS Credits:
5 ECTS credits / 132.5 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the 1st period. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:
1. Student understands the block structures of electronic devices and their signal processing paths.
2. Student can identify the interfaces of analog and digital electronics and the software operations.
3. Student is able to identify and classify electronics components and compare their properties.
4. Students can describe electric conductivity and apply the phenomenon on designing and choosing resistors.
5. Student is able to estimate the difference between dielectric materials and how they affect the properties of a capacitor.
6. Student can compare properties of magnetic materials and how identify they effect on inductive components.
7. Student can identify semiconductivity and is able to list typical semiconductor components.
8. Student can classify different circuit board techniques and is able to choose proper coupling techniques.
9. Student can identify the future technologies of electronics materials.

Contents:

Mode of delivery:
Face-to-face teaching and independent work.

Learning activities and teaching methods:
The implementation methods of the course vary. The course will be arranged utilizing activating teaching methods agreed on together with the students. There will be 48 hours of guided teaching events and 84.5 hours of teaching without guidance either privately or in a group.

Target group:
First year electrical engineering students.
Prerequisites and co-requisites:
No prerequisites.

Recommended optional programme components:
-

Recommended or required reading:
Lecture material; Materials science and engineering: an introduction / Willam D. Callister, chapters 1, 18 and 20; Electronic components and technology / S. J. Sangwine. Chapters 1,2,3,5 and 7

Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are two intermediate exams. In addition students will make course work which are graded. The assessment of the course is based on the learning outcomes of the course. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jari Hannu

Working life cooperation:
No

Other information:
-

521302A: Circuit Theory 1, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikko: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Rahkonen, Timo Erkki
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
Finnish. Exams can be arranged in English on demand.

Timing:
Spring, period 4

Learning outcomes:
After the course the student can
1. write and solve the equations describing the operation of a given electrical circuit
2. solve the sinusoidal steady-state solution using complex phasor arithmetics
3. solve time responses of electric circuits
4. simplify electrical circuits e.g. using equivalent circuits
5. simulate simple circuits and choose an appropriate circuit simulation method

Contents:

Mode of delivery:
Classroom.
Learning activities and teaching methods:
30h lectures, 22h exercises, and a simulation exercise.

Target group:
Finnish BSc students.

Prerequisites and co-requisites:
Matrix algebra, complex arithmetics, differential equations.

Recommended optional programme components:
Background to all analog electronics courses.

Recommended or required reading:

Assessment methods and criteria:
Final exam. Also the simulation exercise must be passed.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
1-5

Person responsible:
Prof. Timo Rahkonen

Working life cooperation:
-

Other information:
-

461106A: Dynamics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Koivurova Hannu
Opintokohteen kielet: Finnish

Leikkaavuudet:
461018A-01 Dynamics, examination 0.0 op
461018A-02 Dynamics, exercises 0.0 op
461018A Dynamics 4.0 op

ECTS Credits:
5 ECTS credits / 120 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2st spring semester.

Learning outcomes:
The aim of this course is to provide students with the ability to examine the relationship between the forces on a solid body and the resulting motion, position, speed and acceleration of the body. Learning outcomes:
Upon completing the required coursework, the student knows and is able to explain the fundamental quantities and the base laws of the classical mechanics. He/she is able to choose an appropriate coordinate system and analyze the motion - position, velocity, and acceleration - of the parts of a device.
The student is able to draw a free body diagram of a moving system, and compose and derive the equations of motion for a system using the direct momentum method, the work-energy method, and the impulse-momentum method.

Contents:
Introduction; Kinematics of a particle; Plane kinematics of a rigid body; Kinetics of a particle; Basics of mechanical vibrations; Kinetics of a system of particles; Plane kinetics of a rigid body.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 45 h / Exercise 30 h / Self-study 45 h.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are three intermediate exams. In addition to this, the students will be asked to calculate homeworks, and theses homeworks will be assessed. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Moodle Study Portal.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University Lecturer Hannu Koivurova

462110S: Advanced course in mechatronics, 8 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Toni Mikael
Opintokohteen kielet: Finnish
Leikkaavuudet:

462052S Advanced Course in Mechatronics 8.0 op

ECTS Credits:
8 cr / 213 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 5th autumn semester.

Learning outcomes:
Upon completion of the course, the student will be able to analyze and design mechatronic products using modern calculation and simulation methods. The student is able to choose the appropriate technology for a mechatronic system. He/she is also able to compare the various technologies. In addition to this, the student is able to assess the feasibility, performance and preconditions of different kinds of actuators in mechatronic products.
Contents:
Technology of digital control systems; Characteristics of dynamical systems and their behavior in time and frequency domain; Modelling and simulation of mechatronic systems; Basics of advanced vibration damping systems and their control; Modelling of friction; Experimental research of mechatronic systems.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 16 h / Group work 32 h / Self-study 165 h

Target group:
Master's degree students of mechanical engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: Actuators in Machine Automation, Mechatronics, Simulation and Modelling of Machines

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, exercises, seminars, assignment and exam. The more detailed assessment criteria are available on the Noppa Study Portal.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Lecturer Toni Liedes

521160P: Introduction to Artificial Intelligence, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Riku Hietaniemi
Opintokohteen kielet: English
Leikkaavuudet:
   ay521160P   Introduction to Artificial Intelligence (OPEN UNIV)   5.0 op

ECTS Credits:
5 ECTS credits /135 hours of work

Language of instruction:
Finnish, English
Lectures and main material in Finnish. English material for self study available.

Timing:
Period IV in spring semester. Recommended completion year: first or second.

Learning outcomes:
Upon completion the student the student will have the elementary skills to identify the potentially applicable artificial intelligence techniques for solving problems. He/she can recognize search, regression, classification, and clustering problems, and to explain the use of supervised and nonsupervised learning, performance measurements and metrics.

Contents:
Mode of delivery:
Face-to-face teaching. Online learning option available.

Learning activities and teaching methods:
Mode of delivery: Online teaching. Lectures 42h / exercise work 70 h / self-study 23 h. The exercises can be completed individually or as group work in multi-disciplinary teams.

Target group:
All Bachelor level students.

Prerequisites and co-requisites:
No prerequisites. Python programming skills are highly recommended.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
All course material (lectures and exercises) are available in course Moodle space.

Assessment methods and criteria:
The course utilizes continuous assessment. During the course there are five intermediate exams which will be used in final evaluation. The course also includes five exercises of which at least four need to be passed. These exercises can be completed individually or in groups.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Riku Hietaniemi

Working life cooperation:
Experts from industry are invited to present real world artificial intelligence solutions.

Other information:
Course learning environment is in Moodle moodle.oulu.fi.

Production engineering

462104A: Machine automation, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Louhisalmi, Yrjö Aulis
Opintokohteen kielet: Finnish
Leikkaavuudet:

462022S-01 Machine Automation II, examination 0.0 op
462022S-02 Machine Automation II, exercise work 0.0 op
462022S Machine Automation II 5.0 op

ECTS Credits:
5 cr / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

**Learning outcomes:**
Upon completion of the course, the student will be able to explain the basic principles and structures of a typical machine automation system. The student is able to divide an automation system into basic elements and explain their role and significance in the system. The student can apply the basic digital technology and logic methods in designing a typical machine automation system. In addition to this, the student knows the operating principles of programmable logic controllers (PLCs) and is able to implement a logic control for a typical application. Furthermore, the student is able to explain the basic principles of fieldbuses. The student also knows the basics of machine automation safety design.

**Contents:**
Basics of automation; Basics of digital technology and logic; Description of operation sequences; Architecture of programmable logic controllers and their programming; Distributed systems and fieldbuses.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures 32 h / Group work 16 h / Self-study 85 h

**Target group:**
Bachelor's degree students of mechanical engineering

**Prerequisites and co-requisites:**
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: Actuators in Machine Automation, Elementary Programming

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time. However, it is recommended to complete the course Machine Sensor Technology simultaneously.

**Recommended or required reading:**
Lecture material. Other material is in the beginning of the course.

**Assessment methods and criteria:**
This course utilizes continuous assessment. The assessment can be based on learning diary, homework, exercises, seminars and exam.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University teacher Yrjö Louhisalmi

463104A: Advanced manufacturing methods, 7 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Mechanical Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Jyri Porter
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 463068S-01 Laser Processing, examination 0.0 op
- 463068S-02 Laser Processing, exercises and seminars 0.0 op
ECTS Credits:
7 cr / 187 hours of work

Language of instruction:
Finnish, the course can also be completed in English

Timing:
Organized during the autumn semester. Lectures and seminar during period 1, demonstrations and practical work during period 2.

Learning outcomes:
The student can apply laser machining processes, electrical discharge machining, abrasive water jet cutting and additive manufacturing processes in today's machine shops as well as choose suitable equipment for various applications. The student can also describe the main features, capabilities, limitations and trends of the aforementioned processes.

Contents:
Classes and seminars deal with the fundamentals and equipment of laser material processing, electrical discharge machining, abrasive water jet cutting and additive manufacturing processes. Other processes may be added as deemed suitable. Material interaction, process and equipment possibilities and limitations. Additionally, safety and health aspects of the processes are covered.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
The course consists of lectures and seminars 46h, preparation for the seminars 34h, demonstrations 10h, practical work as a group project 70h, final exam 3h and preparation for the exam 24h. The project work is flexible and enables realization of student-initiated project ideas.

Target group:
Mechanical engineering students in their Bachelor's studies, 3rd year.

Recommended optional programme components:
Production technology studies in general.

Recommended or required reading:

Assessment methods and criteria:
Final exam. The final grade is based on the combined points from the exam (0.4), seminar and practical work (0.6).

Grading:
1 to 5, zero denotes failure to pass.

Person responsible:
Jyri Porter

Other information:
The course objective is to familiarize students especially with methods for manufacturing parts used in mechanical engineering. Methods covered in the course are alternative or supplementary to traditional manufacturing methods.

463109S: Computer aided manufacturing, 7 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouko Heikkala
Opintokohteen kielet: Finnish

Leikkaavuudet:
- 463059S-01 Computer aided manufacturing, examination 0.0 op
- 463059S-02 Computer aided manufacturing, exercise work 0.0 op
- 463059S Computer Aided Manufacturing 4.0 op

ECTS Credits:
7 ECTS

Language of instruction:
Finnish

Timing:
Lectures and exercises at period 2.

Learning outcomes:
The aim of the course is to introduce the students to the methods and systems used in Computer Aided Manufacturing (CAM) through lectures, demonstrations and personal exercises. After the course the student will be able to use computer-assisted methods and systems in connection with the various manufacturing processes of the workshops. The student is able to describe the main features, possibilities and limitations of methods and systems, as well as trends in the field. In addition, he / she can apply his / her knowledge to solve practical problems.

Contents:
Different areas of digital engineering and their interfaces. Computer aided programming and simulation of numerically controlled (NC) machine tools used in manufacturing and the various steps of generating and processing control data. Connection of machine tools to NC programming systems and manufacturing systems. Industrial robots and workshop automation. Analysis and software correction of machining errors. Methods for measuring surface and shape. Methods of rapid preparation and their use. The exercises will introduce you to the areas of computer-aided manufacturing and apply the information to solve various practical problems.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures and assignments. There are three different CAM programs used for teaching: Dassault Systems Cat, Siemens NX and Autodesk Inventor.

Prerequisites and co-requisites:
463102A Production Technology I.

Recommended or required reading:

Assessment methods and criteria:
Final exam. The final grade is based on the combined points from the exam (grade 0.6) and exercises (grade 0.4).

Grading:
Numerical grading scale 1-5.

Person responsible:
Jouko Heikkala

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
A440249: Supplementary Module, Process Engineering, 20 - 30 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Process engineering

477304A: Separation Processes, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Muurinen, Esa Ilmari
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
Finnish, can be completed in English as a book examination.

Timing:
Implementation in autumn semester during the 2nd period. It is recommended to complete the course on the third (Bachelor's) autumn semester.

Learning outcomes:
After the course the student is able to define the position of separation processes based on mass transfer in process and environmental engineering. He/she is capable of solving phase equilibrium problems in multistage separations for binary mixtures. The student is able to explain the phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. He/she recognises the equipment used for these processes and is able to compare the methods to each other with heuristic rules.

Contents:
Separation processes based on mass transfer in process and environmental engineering. Phase equilibrium problems in multistage separations for binary mixtures. Phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. Equipment used for these processes and is able to compare the methods to each other with heuristic rules, etc.
**Mode of delivery:**
Face-to-face teaching in Finnish. Book examination possible in English.

**Learning activities and teaching methods:**
Lectures 40 h, exercises 20 h, homework 15 h and self-study 58 h. For foreign students written examination based on given literature and homework.

**Target group:**
Bachelor's degree students of process and environmental engineering.

**Prerequisites and co-requisites:**
Courses 477301A Momentum Transfer, 477302A Heat Transfer and 477303A Mass Transfer; or 477052A Fluid Mechanics and 477312A Heat and Mass Transfer are recommended beforehand.

**Recommended optional programme components:**
This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

**Recommended or required reading:**

**Assessment methods and criteria:**
Examination. The course can be completed with three intermediate exams or one final exam. Homework assignments affect the course grade.

Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria.

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Laboratory manager Dr Esa Muurinen.

**Working life cooperation:**
No

**477203A: Process Design, 5 op**

**Voimassaolo:** 01.08.2005 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Process and Environmental Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opetajat:** Ahola, Juha Lennart
**Opintokohteen kielet:** English

**Leikkaavuudet:**
480310A Fundamentals of Process Design 5.0 op

**ECTS Credits:**
5 ECTS /133 hours of work

**Language of instruction:**
English

**Timing:**
Period 4

**Learning outcomes:**
The student is able to identify the activities of process design and the know-how needed at different design stages. The student is capable of utilising process synthesis and analysis tools for creating a preliminary process concept and pointing out the techno-economic performance of the process concept based on holistic criteria.

Contents:
Acting in process design projects. Safety and environmentally conscious process design. Design tasks from conceptual process design to plant design, especially the methodology applicable for preliminary process and plant design.

Mode of delivery:
Lectures and process design exercises in groups.

Learning activities and teaching methods:
Lectures 30 h, group work 50 h and self-study 50 h.

Target group:
Bachelor students in Process and Environmental Engineering.

Prerequisites and co-requisites:
Objectives of 477202A Reactor analysis and 477304A Separation processes.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
Combination of a final exam or two midterm exams and group design exercises. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:
Scale 0-5

Person responsible:
Dr Jani Kangas

Working life cooperation:
-

Other information:
-

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Satu Pitkäaho
Opintokohteen kielet: English
Leikkaavuudet:

470226S Catalytic Processes 5.0 op

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
English
Timing:
Implementation in autumn semester, during 1st period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:
Student recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes, energy production, and environmental engineering. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, and the importance of catalyst research.

Contents:

Mode of delivery:
Lectures including design exercises, face-to-face teaching.

Learning activities and teaching methods:
Lectures 20 h, exercises 10 h, teamwork presentations 20 h, portfolio work 40 h and self-study 60 h.

Target group:
Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
488212A Katalyysin perusteet or 488309A Biokatalyyysi

Recommended or required reading:
-

Assessment methods and criteria:
Portfolio and written examination

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Satu Pitkäaho and Esa Turpeinen

Working life cooperation:
No

477204S: Chemical Engineering Thermodynamics, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Tanskanen, Juha Petri
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS /135 hours of work
Language of instruction:
Finnish
Timing:
Period 1 (autumn term)
Learning outcomes:
By completing the course, the student understands classical thermodynamics from a chemical engineering viewpoint. Especially she/he can explain the pVT behaviour of pure substances and understands the
thermodynamic properties of mixtures. The student can classify the thermodynamic models describing, for example, liquid mixtures. The student can select appropriate models for gas, vapour and liquid phases. In addition, the student can solve process models, phase equilibrium and chemical reaction equilibrium problems, and more generally, is able to evaluate chemical processes using thermodynamic analysis tools.

**Contents:**
Mass and energy balances, pVT behaviour of pure substances, thermodynamic properties of fluids, chemical reaction equilibrium, vapour/liquid equilibrium, introduction to the use of Aspen Plus in the calculation of a thermodynamic equilibrium state, calculation of thermodynamical state functions, thermodynamic analysis of processes.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 46 h and self-study 87 h

**Target group:**
Students in the study options of Chemical Engineering, and Bioproducts and bioprocesses.

**Prerequisites and co-requisites:**
Essential contents of 477401A Thermodynamic equilibria course, or equivalent knowledge on the basic concepts of thermodynamic equilibria.

**Recommended or required reading:**

**Assessment methods and criteria:**
Combination of a final exam and home exercises.
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Dr Jani Kangas

**Working life cooperation:**
No

**Other information:**
-

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**Process Engineering B**

477123S: Chemical processing of biomasses, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Process and Environmental Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Elisa Koivuranta
**Opintokohteen kielet:** English
**Leikkaavuudet:**

477104S Chemical Processing of Biomasses 3.0 op

**ECTS Credits:**
5 ECTS /133 h of work

**Language of instruction:**
English
Timing:
Implementation in autumn period 1

Learning outcomes:
Upon completion of the course, a student should be able to explain the value chain of chemical processing of renewable lignocellulosic raw materials to pulp and different end-products. A student is able to identify lignocellulosic raw material sources, their properties, their main components and utilization potential of components. The student also identifies the unit operations of chemical pulping processes, can explain their operational principles and their objectives in the process and their role in end product properties. Besides cellulose fibre production, the student get familiar with novel bioproduct applications.

Contents:
Lignocellulosic raw materials, fundamentals of chemical pulping, recovering of chemicals in kraft pulping, fiberline in kraft pulping, side products, environmental aspects and novel applications.

Mode of delivery:
Blended teaching.

Learning activities and teaching methods:
Lectures and exercises max. 20 h, homework and self-study 113 hours.

Target group:
Students interested in bioeconomy.

Prerequisites and co-requisites:
488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment including intermediate exam with web learning and homework. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
A visit/excursion to the local pulp mill and/or visiting lecturers from the industry, when feasible.

Other information:
-

477124S: Mechanical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohteen kielet: English
Leikkaavuudet:

477105S Mechanical Processing of Biomasses 3.0 op
ECTS Credits:
5 ECTS / 133 h of work

Language of instruction:
English

Timing:
Implementation in autumn period 2.

Learning outcomes:
Upon completion of the course, a student should be able to explain the value chain of mechanical and chemimech processing of renewable lignocellulosic raw materials. Upon completion of the course, a student should be able to identify the unit operations of mechanical and chemi-mechanical pulping process and can explain their operational principles. The student can evaluate the raw material properties and importance of different unit processes on the quality of the end products. In addition, the student can compare fibre properties of different mechanical and chemi-mechanical pulps and wood powders and can explain their effects on the quality of the end product. Student can explain production principle of engineered wood, biocomposites and pelletizing.

Contents:
Processing of wood, mechanical fibres, wood powders: raw material properties, mechanical and chemimechanical defibering, screening, bleaching, biomass micronization and pulverization, the production of engineered wood, wood-plastic composites and pellets. End product properties.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
The implementation methods of the course vary. Lectures and exercises max. 34 h, web learning and self-study 99 h. A part of the teaching can be replaced by group work or home work.

Target group:
Students interested in bioeconomy.

Prerequisites and co-requisites:
488052A Introduction to Bioproduct and Bioprocess Engineering is recommended

Recommended or required reading:
Book series: Fapet Oy. Papermaking Science and Technology, book 5: Mechanical Pulping. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:
This course utilizes continuous assessment including intermediate exam(s) with potential web learning and homework. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
Visiting lecturers from the industry and/or a visit/excursion to a local manufacturing site, when feasible.

477126S: Manufacturing of fibre products, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohteen kielet: Finnish
Leikkaavuudet:
477107S  Paper Manufacture  3.0 op
477106S  Recycled Fiber Processes  3.0 op

ECTS Credits:
5 ECTS / 133 h of work

Language of instruction:
Finnish

Timing:
Implementation in spring period 4.

Learning outcomes:
Upon completion of the course, a student should be able to identify the unit operations paper and board manufacturing and can explain their purpose of use. The student can name the most important chemicals, fillers and coating pigments and can explain their importance in paper and board making. The student can present the essential properties of papermaking fibres, the structure and properties of paper and board, as well as different paper and board grades. The student knows the fundamentals of printing technology and identifies paper properties essential for printing.

Contents:
Properties of fibers, web forming, chemicals in paper manufacture, coating process, structure and properties of paper, paper processing, paper grades, and fundamentals of printing technology.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (in Finnish) 42 h, a written case study as group work, which is presented to course participants, 40 h. Excursion to local paper mill and printing laboratory 3 h. Self-study 48 h.

Target group:
Students interested in bioeconomy.

Prerequisites and co-requisites:
488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended or required reading:
Book series: Fapet Oy. Papermaking Science and Technology, books 8-11, and 13. Lecture materials and other materials that will be announced at the lectures. Separate study material for the English book exam for foreign students.

Assessment methods and criteria:
Examination and other evaluation methods.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
Lecturer from the industry.

477128S: Circular Bioeconomy, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohteen kielet: English
Leikkaavuudet:
ay477128S  Circular Bioeconomy (OPEN UNI)   5.0 op
477125S  Recycling of bioproducts   5.0 op
477106S  Recycled Fiber Processes   3.0 op

ECTS Credits:
5 cr

Language of instruction:
English

Timing:
Implementation in the spring period 3.

Learning outcomes:
Upon completion of the course, a student should be able to recognize the incentives for the recycling of bioproducts and residues from forest industry. Student is familiarized with circular bioeconomy at the state-of-art level. Student is able to identify the challenges (properties, transportation ect.) of raw materials and their processing, can propose solutions and has ability to review the sustainability of final products.

Contents:
Reuse, recycling and utilization of bioproducts and side streams of forest industry in accordance with principles of circular bioeconomy. The properties and processing of raw material. Novel applications in circular bioeconomy.

Mode of delivery:
Lectures, group meetings and project work.

Learning activities and teaching methods:
Work load in the course is totally 133h. The number of lectures can vary but project working is main activities in the course.

Target group:
Students interested in circular bioeconomy.

Prerequisites and co-requisites:
488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:
The assignment and seminar. More information about assessment methods is given during the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
Visiting lecturers from the industry, when feasible.

Other information:
This Course replace course 477125S Recycling of bioproducts, 5 cr.

Automation engineering

477621A: Control System Analysis, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Course: Control System Analysis

ECTS Credits: 4.0 op

Language of instruction: Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing: Period 1 (autumn term)

Learning outcomes:
After completing the course the student can describe the process dynamics with mathematical and graphical methods. The student can independently: form linear process models, analyse linear system stability, Bode diagrams, Routh’s stability criterion and the Jury’s test, and evaluate the behavior of processes through time and frequency range specifications.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises

Target group:
B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:
The courses 477011P Introduction to process and environmental engineering I, 488010P Introduction to process and environmental engineering II, and 477051A Automation engineering recommended beforehand

Recommended optional programme components:
None

Recommended or required reading:

Assessment methods and criteria:
Exam and in addition extra points from homeworks

Grading:
Numerical grading scale 1-5 or fail

Person responsible:
Jukka Hiltunen ja Enso Ikonen

Working life cooperation:
No

477622A: Control System Design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ikonen, Mika Enso-Veitikka
Opintokohteen kielet: Finnish
Leikkaavuudet:
477603A Control System Design 4.0 op

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:
Period 3 (spring term)

Learning outcomes:
After completing the course the students can apply mathematical and graphical methods to the dynamics of process characterisation and control design. The student can form PID controllers for the process, and tune them and evaluate the closed-loop requirements.

Contents:
Laplace-level vs, time level, poles of the system, closed loop and its design specifications, PID control and tuning, Matlab control designer tool, control design in frequency domain.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises

Target group:
B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:
The courses 477011P Introduction to process and environmental engineering I, 488010P Introduction to process and environmental engineering and 477602A Control system analysis recommended beforehand

Recommended optional programme components:
None

Recommended or required reading:

Assessment methods and criteria:
Exam

Grading:
Numerical grading scale 1-5 or fail

Person responsible:
Professor Enso Ikonen and university teacher Seppo Honkanen

Working life cooperation:
No

477524S: Process Optimization, 5 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Aki Sorsa
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay477524S Process Optimization (OPEN UNI) 5.0 op
477504S Process Optimization 4.0 op

ECTS Credits:
5 ECTS /135 hours of work

Language of instruction:
English

Timing:
Spring semester, the 3th period. Recommended for 1st year M.Sc. students.

Learning outcomes:
Student can use and apply standard unconstrained and constrained optimization methods. Student understands the basic of evolutionary optimization algorithms and can use them. Student can define and identify optimization problems. Student is able to summarize the role of optimization in process engineering.

Contents:

Mode of delivery:
Face-to-face teaching and exercises.

Learning activities and teaching methods:
The amount of guided teaching is 40 hrs. Contact teaching includes, depending on situation, lectures, group work and tutored group work. During self-study time student does independent or group work.

Target group:
M.Sc. students of process and environmental engineering and M.Sc. students interested in process optimization. Exchange and other international students.

Prerequisites and co-requisites:
No prerequisites but basic understanding on numerical methods and process modelling are useful.

Recommended optional programme components:
See prerequisites

Recommended or required reading:

Assessment methods and criteria:
This course uses continuous assessment that includes homework and classroom or home exams.

Grading:
The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Aki Sorsa

Working life cooperation:
No

477624S: Control System Methods, 5 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: István Selek
Opintokohteen kielet: Finnish
Leikkaavuudet:

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<td>477605S</td>
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ECTS Credits:
5 ECTS / 135 hours of work

Language of instruction:
English

Timing:
Period 1 (autumn term)

Learning outcomes:
After completing the course, one understands the relevance and building blocks of model-based control design and system analysis. Relying on data-driven approaches, this course provides strong foundations for digital control design considering real-life applications.

Contents:

Mode of delivery:
Regular lectures

Learning activities and teaching methods:
Lectures and exercises including guided computer simulations

Target group:
M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:
The courses 477621A Control system analysis and 477622A Control system design are recommended beforehand.

Recommended or required reading:
Lecture handout;

Assessment methods and criteria:
Completion of homeworks and final (written) exam.

Grading:
Numerical grading scale 1-5 or fail.

Person responsible:
István Selek

**Working life cooperation:**
No

### 555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

- **Voimassaolo:** 01.08.2015 -
- **Opiskelumuoto:** Advanced Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Osmo Kauppila
- **Opintokohteen kielet:** Finnish
- **Voidaan suorittaa useasti:** Kyllä

**Person responsible:**
University lecturer Osmo Kauppila

### A440263: Complementary Module, Civil Engineering, 20 - 30 op

- **Voimassaolo:** 01.08.2015 -
- **Opiskelumuoto:** Supplementary Module
- **Laji:** Study module
- **Vastuuysikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Structural Engineering*

### 485109A: Numerical methods in structural engineering, 5 op

- **Voimassaolo:** 01.08.2019 - 31.07.2021
- **Opiskelumuoto:** Intermediate Studies
- **Laji:** Course
- **Vastuuysikkö:** Civil Engineering field
- **Arvostelu:** 1 - 5, pass, fail
- **Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

- 485121S Numerical methods in structural engineering  5.0 op
- 466103A Project work in structural engineering  5.0 op

**ECTS Credits:**
5 ETCS / 135 hours of work

**Language of instruction:**
Lectures in Finnish. Lecture notes in English. Foreign students can participate by studying independently the material and by carrying out the exercise work and exam in English.

**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course during the 4th year of studies.

**Learning outcomes:**
Ability to carry out structural analysis by using advanced numerical simulation technology. Knowledge of and ability to develop methods for verification of model data and accuracy of numerical solutions. Ability to present results of calculations in writing. Knowledge of different variational and energy principles of mechanics and ability to apply them in structural analysis. Knowledge of the properties of different structural models and ability to formulate an appropriate and validated mathematical model for specific problems. Knowledge of some special features concerning the analysis and dimensioning of steel, concrete and timber structures. Knowledge of special features of plate and shell structures from the viewpoint of structural design.

Contents:

Mode of delivery:
Face-to-face and independent study.

Learning activities and teaching methods:
Lectures and exercises 48 h, project work 24 h and independent work 63 h.

Target group:
Master level students in the study areas of structural engineering and engineering mechanics in the degree programs of civil and mechanical engineering, respectively.

Prerequisites and co-requisites:
Basic knowledge of statics, solid mechanics and differential & integral calculus.

Recommended optional programme components:
The course supports advanced courses in structural engineering and engineering mechanics.

Recommended or required reading:
Lecture notes and other electronic material.

Assessment methods and criteria:
The course is passed by partial exams during the course or by a final exam. A project work is also required.

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Senior research fellow Antti H. Niemi

Working life cooperation:
-

Other information:
-

485106A: Design of concrete structures, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
466107S  Design of concrete structures  6.0 op
460147A  Introduction to Design of Concrete Technology  4.0 op
460147A-01  Introduction to Design of Concrete Technology, examination  0.0 op
460147A-02  Introduction to Design of Concrete Technology, exercise work  0.0 op
460148S  Design of Concrete Structures  4.0 op
460148S-01  Design of Concrete Structures I, examination  0.0 op
460148S-02  Design of Concrete Structures I, exercises  0.0 op
ECTS Credits: 5 ects
Language of instruction: Finnish
Timing: Lectures and exercising on periods 3 and 4.

Learning outcomes: Upon completion of the course, the student will be able to design typical reinforced concrete structures to EN-standards.

Contents: Strength and strain properties of concrete and reinforcing bars, time dependent properties. Limit state design of concrete beams and columns to EN standards. Service life design. Fire design. Anchoring and joints of reinforcing bars. Design of flanged cross sections, walls and wall like beams, and foundations carrying walls and columns.

Mode of delivery: Face-to-face teaching

Learning activities and teaching methods: Lectures and exercises 48 h, project work 24 h and independent work 63 h

Target group: Bachelor level students in the degree program of civil engineering

Prerequisites and co-requisites: Basic knowledge of statics, solid mechanics, concrete technology and structural engineering

Recommended or required reading:

Assessment methods and criteria: The course is passed by partial exams during the course or by a final exam. A project work is also required.

Grading: The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible: Senior research fellow Antti H. Niemi

Other information: This course will replace course 466107S Design of concrete structures in Academic year 2020-21.

485108A: Desing of Steel Structures and Steel Construction, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

466105S Design of Steel Structures 6.0 op
ECTS Credits: 5 ects

Language of instruction: Finnish

Timing: Periods 1 and 2

Learning outcomes: After completing the course the student is capable of explaining the crystalline structure of steel material and he understands elasto-plastic material model. He is able to explain the effect of inclusions, heat treatment and welding process to the mechanical properties of a steel material. The student is familiar with fire design of steel structures. He is able to explain common types of corrosion. The student is able to design the most typical joints in a steel frame and he can analyze simple steel structures. He is also able to analyze stability problems and explain the effects of imperfections and second order effects on frame behavior and member forces.


Mode of delivery: Face-to-face

Learning activities and teaching methods: Lectures, exercises and self-study.


Assessment methods and criteria: Three midterm exams or one final exam is required. One design exercise is required.

Grading: The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible: Matti Kangaspuoskari

Other information: This course will replace course 466105S Design of Steel Structures in Academic year 2020-21.
485401A: Basics of Traffic Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Virve Merisalo
Opintokohteen kielet: Finnish
Leikkaavuudet:
488151A Basics of Traffic Engineering 5.0 op

ECTS Credits:
5 ECTS / 135 h of work

Language of instruction:
Finnish

Timing:
Period 1

Learning outcomes:
By completing the course the student knows the basics of modes of transport, the significance of traffic and transportation to society, traffic planning and research methods, transport economics and the external effects of transport.

Contents:
Modes of transport, Need for traffic and transportation, Transport planning and research, Economical and environmental impacts of traffic, Traffic safety.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h

Target group:
Students in the Bachelor's Programme of Civil Engineering

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Materials delivered during the lectures

Assessment methods and criteria:
Examination and exercises

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Virve Merisalo

Working life cooperation:
-

Other information:
-
**485402S: Advanced Course in Traffic Engineering, 5 op**

**Voimassaolo:** 01.08.2019 -  
**Opiskelumuoto:** Advanced Studies  
**Laji:** Course  
**Vastuuysikkö:** Civil Engineering field  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Virve Merisalo  
**Opintokohteen kielet:** Finnish  
**Leikkaavuudet:**  

ECTS Credits:  
5 ECTS / 135 h of work  
**Language of instruction:**  
Finnish  
**Timing:**  
Period 2  
**Learning outcomes:**  
By completing the course the student understands the basics of transport policy and the significance of transport economics to society. The student becomes familiar with traffic safety and is able to analyse the problems of traffic safety and opportunity to improve it.  
**Contents:**  
Transport policy, transport economics, traffic safety  
**Mode of delivery:**  
Face-to-face teaching  
**Learning activities and teaching methods:**  
Lectures 28 h, exercises 22 h, self-study 85 h  
**Target group:**  
Students in the Master's Programme of Civil Engineering  
**Prerequisites and co-requisites:**  
-  
**Recommended optional programme components:**  
The course is an independent entity and does not require additional studies carried out at the same time.  
**Recommended or required reading:**  
Materials delivered during the lectures  
**Assessment methods and criteria:**  
Examination and exercises  
**Grading:**  
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.  
**Person responsible:**  
University teacher Virve Merisalo  
**Working life cooperation:**  
Yes  
**Other information:**  
-  

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**485403A: Basics of Road Engineering, 5 op**

**Voimassaolo:** 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Veikko Pekkala
Opintokohteen kielet: Finnish
Leikkaavuudet:
488153A Basics of Road Engineering 5.0 op

ECTS Credits:
5 ECTS / 135 h of work
Language of instruction:
Finnish
Timing:
Period 3
Learning outcomes:
By completing the course student understands the basics of road design and construction, is able to calculate structure layers of road and is familiar with the maintenance of roads
Contents:
Road and street planning and design, lining, roads structure, maintenance of roads, basics of earthworks
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h
Target group:
Students in bachelor's programmes of environmental engineering
Prerequisites and co-requisites:
-
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Materials delivered during the lectures
Assessment methods and criteria:
Exam, assignment and seminar work
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Veikko Pekkala
Working life cooperation:
-
Other information:
-

485404S: Road Design and Construction, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail  
Opettajat: Veikko Pekkala  
Opintokohteen kielet: Finnish

ECTS Credits:  
5 ECTS / 135 h of work

Language of instruction:  
Finnish

Timing:  
The course unit is held in the spring semester during period 4

Learning outcomes:  
By completing the course student is familiar with road structure and function, structural modernisation, pavements and the basics of earthworks. He/she is also able to design road computer aided.

Contents:  
Function of road structure, road damaging, structural modernisation, pavements, Road design and construction

Mode of delivery:  
Face-to-face teaching

Learning activities and teaching methods:  
Lectures 28 h, exercises 32 h, self-study 75 h

Target group:  
Students in the master's programmes of environmental engineering

Prerequisites and co-requisites:  
485403A Basics of Road Engineering

Recommended optional programme components:  
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:  
Materials delivered during the lectures

Assessment methods and criteria:  
Exam and assignment(s)

Grading:  
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:  
Veikko Pekkala

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555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:  
University lecturer Osmo Kauppila

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A440256: Supplementary Module, Environmental Engineering, 20 - 30 op
**Environmental Engineering A**

488209S: Renewable Energy, 5 op

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Process and Environmental Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Huhtanen, Mika Ensio
**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 135 hours of work.

**Language of instruction:**
English

**Timing:**
Period 1

**Learning outcomes:**
The student is able to define different methods and techniques on renewable energy production field. The student can describe the energy production from renewable sources and is able to compare the environmental impacts of different ways of producing energy. He/she is able to identify main specific characters, challenges and driving forces in the field.

**Contents:**
Renewable energy production methods and technologies. Water and wind power, solar energy, biofuels, biomass conversion, side-streams utilization, power-to-X technologies, emissions and environmental aspects.

**Mode of delivery:**
Contact lectures

**Learning activities and teaching methods:**
Lectures 40h, self-study 95h

**Target group:**
Master’s degree students of Process and Environmental Engineering study programmes.

**Prerequisites and co-requisites:**
Course 488208A Energian tuotannon ja käytön perusteet is recommended.

**Recommended optional programme components:**
The course is pre-requirement for 488206S Sustainable Energy Project course.

**Recommended or required reading:**
Materials delivered via the Moodle environment.

**Assessment methods and criteria:**
Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at [https://www.oulu.fi/forstudents/assesment-criteria](https://www.oulu.fi/forstudents/assesment-criteria)

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University lecturer Mika Huuhtanen

**Working life cooperation:**
No

**Other information:**
This course has replaced the course 488202S Production and Use of Energy.

488501S: Smart Grid I: Integrating renewable energy sources, 5 op

**Voimassaolo:** 01.08.2016 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Process and Environmental Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Eva Pongracz
**Opintokohteen kielet:** English

**ECTS Credits:**
5 cr/150 hours of work

**Language of instruction:**
English

**Timing:**
Period 2

**Learning outcomes:**
The student is able to explain the concept of smart grids, the evolution of smart grids from electricity power grids, the information technology requirements as well as the economic, environmental and social implications of smart grids. The student can explain the basic functioning of energy markets in Finland and the Nordic countries as well as the basics of electricity and carbon pricing. The student is also able to find real time data on variable energy sources (VRES) and able to apply the residual curve equation. The student can also explain the costs of large scale VRES integration and how they can be mitigated. The student can also explain demand site flexibility and the need for flexibility services emerging in the smart grid system. The student will know the expectations from smart grids and is able to outline the future perspectives of smart grid-based energy systems. The student is able to draft a scenario for the decarbonization of the energy system by 2050, and assess its economic, environmental and geopolitical implications, as well as the technological and infrastructural gaps.

**Contents:**
Multidisciplinary course, offered at the Faculty of Technology (Water, Energy and Environmental Engineering research group – WE3), in cooperation with Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC).

After an introductory presentation on the requirements, the background is set on the energy and environmental crisis, the co-evolution of energy and information systems and outlining the transition to a smarter system. Further, lectures on smart grids will be provided from an electrical engineering and information technology view on the evolution of electricity power grids, power generation transmission and distribution; distributed generation and futures of smart grids. From an environmental engineering point of view, lectures will be delivered on energy systems fundamentals, climate goals and decarbonization, as well as on the sustainability of smart grids will in particular the environmental and social impacts of smart grids. From economics points of view, lectures will be given on the liberalization and deregulation of the
electricity market, electricity pricing, transmission and distribution as natural monopolies, smart grids and new market mechanisms, and the economic impacts of large-scale integration of renewable energy sources. Participation on lectures is not compulsory, but students are to answer to problem questions. As an exercise, students will be given a group work assignment that they are to work with throughout the duration of the course with the help of mentors. The subjects of the exercise is achieving climate goals and the future of energy systems.

Mode of delivery:
Implemented as face-to-face teaching and student seminar. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:
Lectures 32 h / student presentations 8 h, Guided group work: 8 h, individual homework 50 h/group work 37 h.

Target group:
Master's students of environmental engineering, especially of energy and environmental engineering orientation; Master's students in economics; Master's students of Electrical Engineering and Information Technology.

Prerequisites and co-requisites:
For Environmental Engineering students, admission to the Master's programme, for which minimally a former bachelor's degree is required. For other students the Bachelor level studies. A minimum of 10 ECTS worth of prior energy studies, bachelor level studies are acceptable. For example at Oulu: 488202S Production and use of energy, 488504S Fundamentals of nuclear energy.

Recommended or required reading:

Assessment methods and criteria:
Answering problem questions and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, participation in 50% of intermediate presentations and compulsory participation in the final presentation.

Grading:
The course evaluation will be based on an on-line learning portfolio and performance in the exercise participation and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

Other information:
The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488502S: Smart Grid II: Smart buildings/smart customers in the smart grid, 5 op

Voimassaolo: 28.11.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eva Pongracz
Opintokohteen kielet: English

ECTS Credits:
5 cr/137 hours of work
Language of instruction:
English

Timing:
Period 3

Learning outcomes:
The student is able to explain the concept of smart houses, and is able to demonstrate the optimization of smart house functions for energy efficiency, decarbonization and cost savings. Further, the student is familiar with the concepts and the technologies of smart house automation as well as other technologies used in smart houses such as smart appliances, smart metering and energy storage. The student will also understand the new role of consumers in the smart grid environment, their changing roles as well as current and future models of energy services. The student will also understand the risks of smart houses in terms of cyber security, data privacy and management. In addition, the student is able to outline the future perspectives of smart houses and smart consumers as part of the smart city framework and aiming toward eco-cities of the future.

Contents:
Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the course requirements, the basics are set in terms of defining smart houses as part of smart grids. Further the complementary roles of smart houses for energy efficiency, costs saving and decarbonization is explained. The key technologies of smart houses will be explained and demonstrated, including company presentations on existing commercial technologies and service models. In addition, the new role of consumers as prosumers and service users will be explained and demonstrated. There will be no exam, however, the students are to answer to problem questions related to the lectures and complete the exercises. There will be 4 exercises, concentrating on the 4 key themes of the course: smart house functions, smart house technologies, smart consumers, and energy services. Part of the exercises will be done as individual work that will be reported and some will be performed as group work. There will also be in-class guided exercises.

Mode of delivery:
Implemented as face-to-face teaching, visiting lectures and student presentations. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:
Lectures 28 h, student presentations 4 h, guided exercise work 24 h, individual work 45 h, group work 34 h.

Target group:
Master's students of environmental engineering, especially of energy systems orientation; Master's students in economics; Master's students of Electrical Engineering and Information Technology. Doctoral students are also welcome to participate.

Prerequisites and co-requisites:
Course 488501S Smart Grid I.

Recommended or required reading:
Will be provided during the course by the lecturers.

Assessment methods and criteria:
Answering problem questions, individual and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, compulsory participation in the in-course exercises and participation in the student presentation.

Grading:
The course evaluation will be based on an on-line learning portfolio, exercise performance and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:
Dr. Jean-Nicolas Louis
Other lecturers: Prof. Eva Pongrácz, Dr. Antonio Caló and Adeleye Adetunji.

Other information:
The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488503S: Smart Grid III: Smart energy networks, 5 op

Voimassaolo: 28.11.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eva Pongracz
Opintokohteen kielet: English

ECTS Credits:
5 cr/150 hours of work

Language of instruction:
English

Timing:
During period 4 in spring semester

Learning outcomes:
The student is able to explain the concept of energy transition, and is able to outline the structure and functioning of smart energy networks. Further, the student is familiar with the concepts of multiple energy networks, integrating multiple energy networks and networks flow analysis. The student will also understand the concept of swarms of distributed energy generation and the need for storage to ensure network stability. The student will also also able to outline the key energy storage methods and will be able to recommend them for distributed vs. centralized storage of both heat and electricity, for long term as well as short term. The student will also be able to use design tools for the planning and evaluation of future energy systems. The student will also be able to assess the dimensions of sustainability of smart energy networks.

Contents:
Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the course requirements, the basics are set in terms of defining energy transition to a carbon neutral energy future. Further the integration of multiple energy networks will be explained, as well as communication within multiple energy networks. The issue of swarms of distributed generation will be explained, as well as communication within multiple energy networks. The issue of swarms of distributed generation will be explained, as well as the economics of a system relying largely on renewables. The key storage technologies will be explained, demonstrating their use for heat or electricity storage, their effectiveness on small or large scale, as well as their purpose and economics of short and long term storage. Communication within the smart grid as well the economics of distributed generation in a future carbon neutral energy system will be explained. Finally, the sustainability assessment of smart energy network performance will be explained. There will be no exam, however, the students will need to answer to problem questions related to the lectures and complete exercises. There will be 3 exercises, concentrating on (1) evaluation of storage technologies, (2) simulation of future smart energy networks and (3) sustainability assessment. The simulation work will be done as group work using the EnergyPlan freeware, for which in-class guidance will be provided. The results of the simulation will have to be presented. The rest will be done as individual work.

Mode of delivery:
Implemented as face-to-face teaching, visiting lectures and student presentations. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:
Lectures 28 h, student presentations 4 h, guided exercise work 24 h, individual work 50 h, group work 38 h.

Target group:
Master’s students of environmental engineering, especially of energy and environmental engineering orientation; Master’s students in economics; Master’s students of Electrical Engineering and Information Technology. Doctoral students are also welcome to participate.
Prerequisites and co-requisites:
Completing Smart grids 1 is a prerequisite, completing Smart grids 2 prior to this course is also recommended.

Recommended or required reading:
Will be provided during the course by the lecturers.

Assessment methods and criteria:
Answering problem questions, individual and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, compulsory participation in the in-course exercises and participation in the student presentation.

Grading:
The course evaluation will be based on an on-line learning portfolio, exercise performance and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:
Prof. Eva Pongrácz (EEE) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: EEE: Dr. Antonio Caló, Dr. Jean-Nicolas Louis; OBS: Enni Ruokamo; CWC: Dr. Jussi Haapola, MSc. Florian Kühlenz

Other information:
The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

Environmental engineering B

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Satu Pitkäaho
Opintokohteen kielet: English
Leikkaavuudet:
  470226S Catalytic Processes 5.0 op

ECTS Credits:
5 ECTS / 133 hours of work
Language of instruction:
English
Timing:
Implementation in autumn semester, during 1 st period. It is recommended to complete the course at the fourth (1 st Master's) autumn semester.
Learning outcomes:
Student recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes, energy production, and environmental engineering. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, and the importance of catalyst research.
Contents:

Mode of delivery:
Lectures including design exercises, face-to-face teaching.
Learning activities and teaching methods:
Lectures 20 h, exercises 10 h, teamwork presentations 20 h, portfolio work 40 h and self-study 60 h.

Target group:
Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
488212A Katalyysin perusteet or 488309A Biokatalyysi

Recommended or required reading:
-

Assessment methods and criteria:
Portfolio and written examination

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Satu Pitkäaho and Esa Turpeinen

Working life cooperation:
No

488203S: Industrial Ecology, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Väisänen, Virpi Maria
Opintokohteen kielet: English
Leikkaavuudet:
ay488203S   Industrial Ecology and Recycling   5.0 op
480370S   Industrial Ecology and Recycling   5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
English

Timing:
Implementation in autumn semester during 1st period.

Learning outcomes:
Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

Contents:
Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

Mode of delivery:
Face-to-face teaching in English.
Learning activities and teaching methods:
Lectures 30 h / Group work 30 h / Self-study 75 h. The exercises are completed as guided group work.

Target group:
Master’s degree students of process and environmental engineering.

Recommended or required reading:

Assessment methods and criteria:
All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Virpi Väisänen

Working life cooperation:
No

488214S: Air Pollution Control Engineering - Practical Solutions, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysiksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Satu Pitkäaho
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
English

Timing:
Implementation in autumn semester during 2nd period first time in Autumn term 2020.

Learning outcomes:
Student is able to explain what kind of air emissions originate from different industrial and energy production sectors. Student deepens knowledge obtained in 488213A course and is able to apply it to different practical emission problems. She/he is able to comprehensively describe, choose, design and optimize emission control technologies. Student understands essential regulations and laws concerning emission control.

Contents:
Principles of air pollution control equipment and their use in real applications. Emission control case studies in industry and energy production sector. Air pollution related regulations and laws.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 30 h, exercises 12 h, homework 8 h, teamwork presentations 10 h, and self-study 75.

Target group:
Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
488213A Ilmansuojeluteknikiikan perusteet
Recommended or required reading:
Materials in the Optima environment. de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 pp

Assessment methods and criteria:
Written final exam or intermediate exams.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Satu Pitkäaho ja Esa Turpeinen

Working life cooperation:
No

Other information:
Replaces the course 488204S Air Pollution Control Engineering.

488215S: Industry and Environment, 5 op
Voimassaolo: 28.06.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Sanna Päiväranta-Antikainen, Väisänen, Virpi Maria
Opintokohteen kielet: English
Leikkaavuudet:
477334S Industrial activities and environment 5.0 op
ay488215S Industry and Environment (OPEN UNI) 5.0 op
488221S Environmental Load of Industry 5.0 op
488205S Environmental Load of Process Industry 4.0 op

ECTS Credits:
5 cr / 135 hours of work

Language of instruction:
English

Timing:
This course will teach first time in Autumn 2020, period 2.
This course replaces course 488221S Environmental Load of Industry.

Learning outcomes:
The student is able to identify the essential features of the environmental load in different types of (chemical, wood, metallurgical, ...) industry. He/she is able to explain the type, quality, quantity and sources of the emissions. The student is familiarized with the main emission control systems and techniques in different industrial sectors. The student can explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

Contents:
Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.
Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 40 h, self-study 93h.

Target group:
Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II, 488204S Air Pollution Control Engineering and 488110S Water and Wastewater Treatment recommended beforehand.

Recommended or required reading:
Material represented in lectures and in the Optima environment.

Assessment methods and criteria:
Written final exam or a learning diary.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:
Virpi Väisänen

Working life cooperation:
No.

Other information:
The course mainly consists of specific lectures presented by experts who are invited from industry.

This course will teach as online course in Fitech in Spring Term 2020.

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**Environmental engineering C**

**488110S: Water and Wastewater Treatment, 5 op**

- **Voimassaolo:** 01.08.2005 -
- **Opiskelumuoto:** Advanced Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Process and Environmental Engineering
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Elisangela Heiderscheidt
- **Opintokohteen kielet:** English

- **Leikkaavuudet:**
  - 480151S Water and Wastewater Treatment 7.0 op
  - 480208S Industrial Water and Wastewater Treatment 3.5 op

- **ECTS Credits:**
  5 ECTS credits/135 hours of work

- **Language of instruction:**
  English

- **Timing:**
  The course unit is held in the autumn semester, during period 1

- **Learning outcomes:**
Upon completion of the course, the student will be able to understand the theory and practicalities behind the most used purification processes in water and wastewater treatment. The student will also be capable of performing basic dimensioning calculations and therefore he/she will be able to dimension structures /units of water and wastewater treatment plants and to comprehend the basic requirements of different purification processes.

Contents:
Water quality characteristics of source water; basic principles of purification processes (coagulation /flocculation, sedimentation, biological treatment, filtration, disinfection, etc); process units in water and waste water treatment; selection of process units; dimensioning of treatment structures and unit processes.

Mode of delivery:
Mix of guided self-study work, face-to-face teaching and field visits.

Learning activities and teaching methods:
Lectures (30 h), field visits (5 h), exercises and other assignments (60 h) and self-study (38 h).

Target group:
Students in master program of environmental and civil engineering.

Prerequisites and co-requisites:
The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering (477013P) or I (477011P) and II (488010P).

Recommended or required reading:

Assessment methods and criteria:
The course can be completed in two different study modes: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) Passive mode (book exam): 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material. (Passive mode can be complete under special circumstances).

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Post-doctoral researcher Dr Elisangela Heiderscheidt

Working life cooperation:
Through visits to water and wastewater treatment plants, which include lectures provided by environmental engineers in charge and guided tours, the students familiarize with the main technological and process related principles of the field and have the chance to experience in firsthand how to deal with some of the most common issues related to water and wastewater purification systems.

Other information:
The course will be held as distance learning in the fall of 2020.

488134S: Hydrogeology and groundwater engineering, 5 op

Voimassaolo: 28.11.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Pekka Rossi
Opintokohteen kielet: English
ECTS Credits:
5 ECTS credits/133 hours of work

Language of instruction:
English

Timing:
The course unit is held in the spring semester, during period 3

Learning outcomes:
Upon completion of the course, the student will have knowledge on groundwater systems and the basic hydrogeological and engineering concepts involved. This includes analysis of flow in porous media, hydraulics of groundwater systems, groundwater quality and groundwater use. After the course students are able to estimate key factors influencing on groundwater recharge, flow and discharge and to use general methods to calculate groundwater flow.

Contents:
2D and 3D groundwater flow, conceptual models, unsaturated layer flow, water storage and retention, heterogeneity and isotropy, aquifer types, pumping tests, geophysical methods, groundwater quality and resources in Finland.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
lectures (18 h), calculus lectures (12 h), homework, exercises and self-study (103 h).

Target group:
Master students in the water engineering orientation of the Environmental Engineering program and in master program of civil engineering.

Prerequisites and co-requisites:
The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes.

Recommended or required reading:
Lecture handouts

Assessment methods and criteria:
exam and/or lecture exams.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Pekka Rossi

Working life cooperation:
Students familiarize themselves to a real groundwater aquifer cases discussed in lectures and in the course exercise.

488135S: Water distribution and sewage networks, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Pekka Rossi
Opintokohteen kielet: English
Leikkaavuudet:
  488144A Water distribution and sewage networks 5.0 op

ECTS Credits:
5 ECTS credits/133 hours of work

Language of instruction:
English

Timing:
The course unit is held in the autumn semester, in period 2

Learning outcomes:
Student knows and understands the systems and dynamics needed for water distribution and waste water networks. Student is able to do basic dimensioning for water distribution network and sewer system of an urban area.

Contents:
Water distribution and waste water network design and dimensioning, Pumping and storage tanks needed in distribution of water and collection of sewage waters, renovation of pipelines, special circumstances in water distribution, effects of cold climate and harmful hydraulic conditions.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (30 h), homework (45 h) and a design exercise (58 h).

Target group:
Students in master program of environmental engineering and in master program of civil engineering

Prerequisites and co-requisites:
Use of AutoCAD-program

Recommended optional programme components:
The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Virtaustekniikka, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and 488051A AutoCAD ja Matlab prosessi- ja ympäristöteknikan työkaluna or at least equivalent information about water management.

Recommended or required reading:
Lecture handout and other materials delivered in lectures. To the appropriate extent: RIL 237-1-2010 Vesihuoltoverkkojen suunnittelu, RIL 237-2-2010 Vesihuoltoverkkojen suunnittelu, RIL 124-2 Vesihuolto II, Mays Water distribution systems handbook

Assessment methods and criteria:
Exam and a design exercise.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Pekka Rossi

Working life cooperation:
Visit to a site of water distribution network building site, pumping station or water supply/sewerage company.

488206S: Sustainable Energy Project, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Huuhtanen, Mika Ensio
Opintokohteen kielet: English
Leikkaavuudet:

ECTS Credits:
5 ECTS / 135 hours of work

Language of instruction:
English

Timing:
Implementation in periods 1 and 2.

Learning outcomes:
The student is able to adapt the (skills) tools learned in previous courses to complete an energy production and management design project. The student will solve an engineering problem related to sustainable energy generation in cold climate. The student is able to describe the key practical issues related to sustainable energy generation. The student will evaluate the relevant instruments, tools and measures required for sustainable energy production, distribution, and end-use efficiency. The student will demonstrate the ability to select the proper tools, and methods to solve the design problem. The student will also acquire skills to work as a member in an engineering design project as part of a team. He/she will gain the experience to carry out a real project and produce a documentation of the engineering solution.

Contents:
A design project to adapt small-scale renewable energy production and management, greenhouse gas reduction and/or utilization, wind, solar, and geothermal energy generation. Management of energy efficiency. Energy engineering and design principles. Performance evaluation and sustainability assessment of the selected project. Problem solving.

Mode of delivery:
Team work, group meetings and seminars

Learning activities and teaching methods:
Lectures (6 h), guided project design in small groups (30 h), individual and group work (80 h) presentations and reporting (20 h).

Target group:
Master’s degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
The course 488209S Renewable Energy is a compulsory.
The 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project.

Recommended or required reading:
Materials delivered on lectures and during the group meetings. Additional literature: Manuals and databases, depends on the project work selected.

Assessment methods and criteria:
Written report with the documentation of the engineering solution and seminar.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Mika Huuhtanen

Working life cooperation:
555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

555306M: Elective Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

Person responsible:
University lecturer Osmo Kauppila

A440269: Special Module, 0 - 10 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Special Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

International students should select 555212P, 030008P and 900017Y

555212P: Orientation Course for New Students, 1 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555203P Study Skills 2.0 op
Person responsible:
University lecturer Osmo Kauppila

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Faculty of Technology
Arvostelu: 1 - 5, pass, fail
Opettajat: Ursula Heinikoski
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
1 ECTS credit / 27 hours of work

Language of instruction:
Finnish

Timing:
Architecture 3. spring semester, period III;
biochemistry 3. autumn semester;
biology 3. autumn semester, period I;
chemistry 3. autumn semester, period I;
civil engineering 2. spring semester, period IV;
computer science and engineering 2. spring semester, period IV;
electronics and communications engineering 3. spring semester;
geosciences 2. spring semester, period IV;
geography 3. semester, periods I and III;
industrial engineering and management 3. year;
information processing sciences 1. or 3. year;
mechanical engineering 3. year;
mining engineering and mineral processing 3. year;
process and environmental engineering 2. year, period II;
Master's degree students in industrial engineering and management 1st year.

Learning outcomes:
Upon completion of the course, the students:
- can search scientific information,
- can use the most important databases of their discipline,
- know how to evaluate search results and information sources,
- can use the reference management tool.

Contents:
Scientific information retrieval process, the most important databases and publication channels of the discipline, evaluation of the reliability of information sources and reference management tool.

Mode of delivery:
Blended teaching: classroom training, web-based learning material and exercises, a group assignment.

Learning activities and teaching methods:
Training sessions 8 h, group working 7 h, self-study 12 h

Target group:
Compulsory for all bachelor degree students of Faculty of information technology and electrical engineering, Faculty of Technology and Faculty of science. Compulsory also for those Master’s degree students in Industrial Engineering and Management who have no earlier studies in the information skills.
Optional for the students of biochemistry.

Recommended optional programme components:
In biochemistry the course is completed as a part of 740376A Bachelor’s Thesis.

**Recommended or required reading:**
Web learning material [Tieteellisen tiedonhankinnan opas](#)

**Assessment methods and criteria:**
Passing the course requires participation in the training sessions and successful completion of the course assignments.

**Grading:**
pass/fail

**Person responsible:**
Ursula Heinikoski

030008P: Information Skills for foreign degree students, 1 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuysikkö:** Faculty of Technology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Klintrup, Outi-Mirjami

**Opintokohteen kielet:** English

**ECTS Credits:**
1 ECTS credits / 27 hours of work

**Language of instruction:**
English

**Timing:**
1st year of Master's Degree Programme in Environmental Engineering (BEE) and in Industrial Engineering and Management (international students). The course is held in the autumn semester, during period II and in the spring semester, during period IV.

**Learning outcomes:**
Upon completion of the course, the students:
- can search scientific information for their thesis,
- know how to evaluate search results and information sources,
- understand the principles of scientific publishing,
- can use a reference management tool.

**Contents:**
Scientific information retrieval and the search terms, the most important databases and publication channels of the discipline, tools for evaluating the quality of scientific information and reference management.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Training sessions 8 h, group work 7 h, self-study 12 h

**Target group:**
The course is compulsory for the Master’s Degree Programme in Environmental Engineering (BEE) and for the Master’s Degree Programme in Industrial Engineering and Management (international students). Optional for other degree students working on their diploma/master’s thesis.

**Recommended or required reading:**
Web learning material: "Finding scientific information"

**Assessment methods and criteria:**
Passing the course requires successful completion of the course assignments.
Grading:
Pass/fail

Person responsible:
Outi Klintrup

900017Y: Survival Finnish, 2 op

Voimassaolo: 01.08.1995 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuysikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
   ay900017Y  Survival Finnish Course (OPEN UNI)  2.0 op

Proficiency level:
A1.1

Status:
The course is intended for the international students in every faculty at the University of Oulu.

Required proficiency level:
No previous Finnish studies.

ECTS Credits:
2 ECTS cr

Language of instruction:
Finnish and English.

Timing:
-

Learning outcomes:
By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.

Contents:
This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the 'where'-question.

Mode of delivery:
Contact teaching, on-line learning and independent work. There will be organized also one on-line group in each semester.

Learning activities and teaching methods:
Lessons 2 times a week (26 h, including the final exam) and guided self study (24 h).

Target group:
International degree and post-graduate degree students, exchange students and the staff members of the University.

Prerequisites and co-requisites:
- 

Recommended optional programme components:
- 

Recommended or required reading:
Will be provided during the course.

Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Grading scale is on a pass/fail basis.

Person responsible:
Arja Haapakoski

Working life cooperation:
- 

Other information:
Sign-up in WebOodi or in Tuudo.

Recommended studies

555214A: Working in the university community, 5 op

Voimassaolo: 01.01.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits

Language of instruction:
Finnish / English

Timing:
Periods 1-4

Learning outcomes:
Upon completion of the course, the student will be able to:
- apply the skills required for the tasks in the university community (communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills)
- take responsibility for the tasks in a responsible manner
- analyse and find development targets related to the tasks

Contents:
Communication, collaboration, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills.

Mode of delivery:
The tuition will not be organised.
Learning activities and teaching methods:
Students complete tasks with their own activities to support the university community and their own professional growth.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management or similar knowledge.

Recommended optional programme components:
-

Recommended or required reading:
-

Assessment methods and criteria:
The course can include several tasks as follows: Student Union 2 years 2 ECTS, University Board 1 year 2 ECTS, University Collegial Body 2 years 2 ECTS, Education Council 1 year 2 ECTS, Education Management Team 1 year 2 years, Faculty Management Team 1 year 2 ECTS, Faculty Board 2 years 2 ECTS, Faculty Education Council 2 years 2op, Student Union Board 1 year 1-3 ECTS, National Student Organisation 1 year 1-5 ECTS, Other major education policy and / or teaching development tasks 1-3 ECTS credits, Student Tutor or Teaching Assistant 2 ECTS cr.

The student writes a report on conducting the tasks, which includes the following: 1) In which positions did the student work, how long and how actively he/she participated? (0.5 pages). 2) What does the student think he/she has learned from the duties and how can the experience be utilized in the future? In particular, these skills should be considered: communication, co-operation, creativity, problem-solving, project management, learning, technical skills, international skills, commercial and financial skills and the development of self-knowledge (1 page). 3) How would the student think that the activity could be developed by the methods of industrial engineering and management? (1.5 pages). A report and a certificate on the tasks will be returned to the teacher tutor, who determines the number of credits to be awarded. The length of the report is 3 pages.

Grading:
pass / fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
-

555215A: Working life project, 5 op

Voimassaolo: 01.01.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits

Language of instruction:
Finnish / English

Timing:
Periods 1-4

Learning outcomes:
Upon completion of the course, the student will be able to:
- apply the skills required for the tasks in the working life (communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills)
- take responsibility for the project in a responsible manner
- analyse and find development targets related to the project

Contents:
Communication, collaboration, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills.

Mode of delivery:
The tuition will not be organised.

Learning activities and teaching methods:
Students complete tasks with their own activities to support their own professional growth.

Target group:
Industrial Engineering and Management students

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management or similar knowledge.

Recommended optional programme components:
-

Recommended or required reading:
-

Assessment methods and criteria:
Participation in a project, competition or similar organized by the academic community, and with a linkage to business life (e.g. Accenture innovation challenge, ESTIEM Times).

The student writes a report on participation in the project, consisting of:
1) In which project did the student work, when and what was the project scope? (0.5 pages).
2) What does the student think he/she has learned from the duties and how can the experience be utilized in the future? In particular, these skills should be considered: communication, co-operation, creativity, problem-solving, project management, learning, technical skills, international skills, commercial and financial skills and the development of self-knowledge (1 page).
3) How did the project succeed and how the project could be developed using IEM methods? (1.5 pages).

A report and a certificate of project completion will be returned to the teacher tutor, who determines the number of credits to be awarded.

Grading:
pass / fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
-

555300S: Master's Thesis, 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Diploma thesis
Learning outcomes:
Upon completion of the course, the student will be able to:
- solve challenging problems in organisations independently
- create a research plan, and define a research problem and research questions
- manage his own work according to the research plan
- utilise different information sources and critically evaluate the information obtained
- create a written report according to the instructions

Contents:
The research topic is selected in co-operation with the instructor.

Mode of delivery:
The tuition will be implemented as self-study and face-to-face teaching.

Learning activities and teaching methods:
Self-study 804 h. The student defines the research topic in co-operation with the instructor. The thesis is typically an empirical or a theoretical study.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent. Courses that support the topic of the thesis.

Recommended optional programme components:
The students will complete 555301S Research seminar in industrial engineering and management simultaneously.

Recommended or required reading:
The instructions and forms related to master's thesis are available at Oulu University's Master's thesis webpage.

Assessment methods and criteria:
This course includes writing a Master's Thesis. The work is assessed by using the thesis assessment form.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
The thesis is typically done for a private or public sector organisation.

Other information:
The general instructions related to thesis, maturity test and graduation are available at the Oulu University's webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.
Substitutes course 477991S Master's Thesis.
Assessment methods and criteria:
Maturity test related to the thesis topic is taken as an electronic exam in the Exam-system. Examination time is settled with the thesis supervisor. The assessor of the maturity test (supervisor) creates the maturity into the Exam system as a personal exam.

Grading:
Pass - Fail

Person responsible:
University lecturer Osmo Kauppila

Other information:
The general instructions related to thesis, maturity test and graduation are available at the Oulu University’s webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.

555307M: Common Studies of the Majors in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

Person responsible:
University lecturer Osmo Kauppila

A440231: Major Studies, Production Management, 40 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

555313S: Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannele Lampela
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits.

Language of instruction:
English
Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of general management
- know the historical developments in the management thought
- have an understanding about the qualifications of a manager in a modern organisation
- understand the principles of the managerial decision making
- distinguish between the terms management and leadership
- have an understanding about good managerial practices

Contents:

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures and case examples from visiting lecturers 20 h, self-study 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on an exam (course book) or on a learning diary (critical lecture notes).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Hannele Lampela

Working life cooperation:
The course includes guest lectures by industry representatives to offer various and topical views to management practice in different types of organizations.

Other information:
-

555314S: Management Information Systems, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannele Lampela
Opintokohteen kielet: English
ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the key concepts of management information systems
- understand the significance of information and information management in modern business and business process management
- define the information needs of management processes and understands how information systems can meet these needs
- recognise the current trends in management information systems technologies and practices and find out the relevant MIS information sources
- participate in enterprise information system designing, purchasing, and development tasks in a role of an industrial engineer/process developer
- strengthen the self-directing, reflective learning skills

Contents:
Key concepts: management information systems (MIS), managerial information, different types of MIS applications, information systems in decision making and leadership, the effects of information technology in business processes and their development. Current trends in management information systems technologies and practices, business driven IT infrastructure and management, special characteristics of business development projects that contain ICT implementation.

Mode of delivery:
The tuition will be implemented as online teaching.

Learning activities and teaching methods:
Self-study and group work 135 h supported by online meetings. The implementation methods of the self-study and group work vary.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent, 555313S Management.

Recommended optional programme components:
Basic understanding of some business process areas helps learning (e.g. production management, supply chain management, sales and marketing management).

Recommended or required reading:
Course materials will be defined at the beginning of the course in Moodle.

Assessment methods and criteria:
This course utilises continuous assessment based on conducting the learning tasks (individual and group work). Since the implementation of self-study and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Hannele Lampela

Working life cooperation:
The course includes the guest lectures of industry to offer various and topical views to MIS in practice.

Other information:
Substitutes the course 555344S Management Information Systems.

555301S: Research Seminar, 5 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannele Lampela
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Teaching during periods 1 - 4. Course can be completed in parts. Course registration is open during 15.8. - 15.5.

Learning outcomes:
Upon completion of the course, the student will be able to:
- know scientific process and different research methods
- select an appropriate method for his/her master's thesis work
- evaluate validity of research work and provide constructive criticism
- report research findings in the form of academic research report and participate in academic discussion

Contents:
Research approach, qualitative and quantitative research methods, structure of research report, evaluating validity of research, constructive criticism and participation in scientific discussion.

Mode of delivery:
Multiform learning, with face-to-face lectures, seminar work and independent learning. The course will use Moodle platform.

Learning activities and teaching methods:
Lectures and seminar work 20 h, independent learning 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
Research report is based on research work student is doing for his/her master's thesis work

Recommended or required reading:
Lecture material. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
The course can be completed in seminar sessions by actively participating in discussion, presenting own research work, giving feedback on other student's research work, acting as an opponent to two ready thesis works, and writing a scientific article on own research topic. The seminar sessions will include three lectures on research approach and qualitative and quantitative research methods, and writing a scientific article. Participation in these three lectures is required to pass the course and they are lectured two times a year.

Grading:
The course utilizes verbal grading "Pass/Fail".

Person responsible:
D. Sc. Hannele Lampela

Working life cooperation:
No.
Other information:
The general instructions related to thesis, matury test and graduation are available at the Oulu University's webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.

555304S: Advanced Internship, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Practical training
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
   555311S   Advanced Internship   3.0 op

ECTS Credits:
5 ECTS cr

Language of instruction:
English

Timing:
Periods 1 - 4 and summer

Learning outcomes:
Upon completion of the course, the student will be able to:
- apply the skills required for the tasks in the working life (communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills)
- take responsibility for the tasks in a responsible manner
- reflect the tasks to IEM studies completed
- analyse and find development targets in IEM courses related to the tasks

Contents:
Communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills

Mode of delivery:
The tuition will not be organised. The student is responsible for finding the internship position that can be a summer job, some other salaried position or work experience, or a position without salary in an organization.

Learning activities and teaching methods:
Students complete tasks with their own activities to support their own professional growth in working-life. Internship duration should be at least 2 months.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
Bachelor's degree or equivalent knowledge.

Recommended optional programme components:
-

Recommended or required reading:
-

Assessment methods and criteria:
The internship must provide at least 2 months working experience related to your studies. Internship period cannot be the same as course 555204A Harjoittelu. The length of the written report is 2-3 pages and it must address the following questions:

- Where (organization name, location) did you perform the internship?
- How did you find this position (PESTI-days or some other way)?
- How was the application procedure? Was there an interview etc?
- Have you worked in this organization earlier?
- What tasks were you doing during the internship period?
- Were these tasks related to your major, supplementary, or engineering studies?
- Which theories or skills in IEM courses were useful in your job?
- What type of topics should be added to the IEM courses based on your internship experience?

The report and a certificate provided by the organization where internship took place must be sent via email to your teacher tutor (Product Management (https://www.oulu.fi/forstudents/tutor-teaching#6503), Tuotantotalouden tutkinto- ja maisteriohjelmat (https://www.oulu.fi/opiskelijalle/omaopettaja#6503)).

Grading:
Pass/ Fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
Yes. The student gains working experience in an organization.

Other information:
Information about internship placements and financial support can be found in Oulu University’s webpage about traineeship. On traineeship issues you can contact the traineeship contact person for Faculty of Technology.

Substitutes the course 555311S Advanced Internship.

555330S: Sourcing Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettaja: Jukka Majava
Opintokohde: Finnish
Leikkaavuudet:
  555323S  Sourcing Management  3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.

Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.

Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

**Mode of delivery:**
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

**Learning activities and teaching methods:**
Face-to-face teaching 20 hrs (lectures/ assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

**Target group:**
Industrial Engineering Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
-

**Recommended or required reading:**
Lecture notes. Other material will be defined at the beginning of the course

**Assessment methods and criteria:**
The assessment is based on the group work.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Adjunct professor Jukka Majava

**Working life cooperation:**
The group work is done in cooperation with case companies.

**Other information:**
Substitutes course 555323S Sourcing Management.

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555331S: Advanced Supply Chain Management, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Jukka Majava
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
555324S Advanced Supply Chain Management 3.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish. English material is also used.

**Timing:**
Periods 3-4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management
- develop and analyse supply networks and create development proposals to improve productivity and competitiveness
- understand the importance of risk management in supply networks
know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

Contents:
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 16 h (lectures/ group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course

Assessment methods and criteria:
The grade will be based on the group work (60 % of the grade) and book examination (40 % of the grade).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Associate professor Jukka Majava

Working life cooperation:
Case organisations’ supply chain related data is utilised in the group works.

Other information:

555332S: Operations and supply network analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppinen
Opintokohteen kielet: Finnish
Leikkaavuudet:

555342S Operations Research 5.0 op

ECTS Credits:
5 ECTS credits.
Language of instruction:
English
Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

Contents:
What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).

Learning activities and teaching methods:
Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

Target group:
Industrial engineering and management students.

Prerequisites and co-requisites:
Bachelor in industrial engineering and management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50%).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
No.

Other information:
Substitutes course 555342S Operations Research.

555333S: Production Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:
   555322S   Production Management   3.0 op

ECTS Credits:
5 ECTS credits.
Language of instruction: English

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production

Contents:
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108 hrs.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Person responsible:  
Yliopistonlehtori Osmo Kauppila

A440259: Complementary Study Module of the Major/ Organization and Knowledge management, Advanced Module, 10 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksovalikoja.

Obligatory studies of Organisation and knowledge management

555370S: Strategic Management, 5 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English

Leikkaavuudet:

555320S Strategic Management 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
• utilise strategic thinking, planning, and management
• analyse and plan complex global business operations
• participate in strategic planning and strategy implementation in organisations
• apply strategy analysis frameworks and analyse the implementation of the chosen strategy

Contents:
Strategic thinking, strategic planning, strategic management, strategy analysis frameworks, strategy implementation with a simulation, analysis of the strategy implementation.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 12 h (lectures 6 h, exercises 6 h), group work 122 h. Alternatively independent learning method: book examination 134 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.
Recommended optional programme components:

- 

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. The group work includes the creation of strategic plan (10% of the grade), business simulation (30 % of the grade), and the analysis of the strategy (60 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:

Other information:
Substitutes course 555320S Strategic Management.

555371S: Human Resource Management, 5 op

Voimassalo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: English
Leikkaavuudet:

555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of human resource management
- utilise methods in analysing and planning of human resource practices in organisations
- participate in human resource practices planning and implementation in organisations
- apply PCMM (People Capability Maturity Model) frameworks
- know the basic Finnish laws, bylaws and trade agreements in the area of human resource management

Contents:
Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures 10 h, assignment guidance 10 h), group work 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Arto Reiman

Working life cooperation:
The group work is done in cooperation with case companies.

Elective advanced studies

555377S: Risk Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:

• explain the key concepts of enterprise risk management and uncertainty management
• explain the role of risk management in organisations and compare the specific features of risk management in different organisational contexts
• identify and classify risks and conduct systematic risk analyses in organisations
• make informed improvement suggestions related to enterprise risk management in organisations
• to develop enterprise risk management processes in organisations

Contents:
Definitions of risk and uncertainty, risk management standards, risk classification models, systematic risk management process, methods of risk management, psychological aspects of risk management, ERM and organising of risk management, risk management in different contexts, risk governance.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 26 h (lectures 26h), self-study 42h, group assignment and cases 66 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture. The materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant Professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555321S Risk Management.

555378S: Seminar in industrial engineering and management, 5 op

Voimassaolo: 01.08.2015
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
555385S Advanced Course in Quality Management 5.0 op
555386S Advanced Course in Project Management 5.0 op
555347S Seminar in Technology Management 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English.

Timing:
Periods 1-4.

Learning outcomes:
Learning outcomes depend on the content of each seminar. The seminar topics are related to production management, product management, organization and knowledge management, project management, and process and quality management.

Contents:
Will be defined at the beginning of the course.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:

555379S: Research Project in Industrial Engineering and Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555367S Exercises in Work Science  6.0 op
555387S Project Work in Quality Management  5.0 op
555388S Project Work in Project Management  5.0 op
555326S Research Project in Production Management  5.0 op
555348S Research Project in Technology Management  5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English

Timing:
Periods 1-4 or as summer studies independently

Learning outcomes:
Learning outcomes depend on the project work contents.

Contents:
Project work topics and types vary. The topics are typically related to actual problems in the industry.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
The methods are agreed with the project work instructor. The work can be done individually or in a group.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
The assessment is based on the project work report.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:

-

Other information:
The objective of the course is to apply the methods of industrial engineering and management in a company’s development activities. The course provides the student with an opportunity to combine and apply his/her existing knowledge in a study project. The student familiarises himself/herself with research work and reporting of the results.

555391S: Advanced Course in Project Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:
  555381S  Project Leadership  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain and describe the most important project management areas and tools
- identify and evaluate the most applicable managerial approaches for different types of projects
- identify development needs and opportunities in project-based organisations
- to develop project management processes in an organisation

Contents:
different type of projects and industry specific approaches to project management, agile project management, managing large international projects, project governance, project risk and uncertainty management, project time and schedule management, management of innovative projects.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures, web-based-lectures and workshops 26h, group exercises and cases 66h, self-study 42h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555285A Basic course in project management.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555381S Project Leadership.

555382S: Management of a project-based firm, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jaakko Kujala
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course student will be able to:
- describe the core areas of the management of the project-based firm
- explain how different internal and external contextual factors affect the business of a project-based firm, and how they should be taken account in the design of a business model
- understand the role of services in the business of a project-based firm
- apply systematic approach to project negotiation
- evaluate the significance of a single project for the business of a project based-firm

Contents:
Contextual factors in project business, business model of a project-based firm, integration of services to the business of a project-based firm, project sales and marketing, contracting, project negotiations (negotiation analytic approach) and organising support functions in project-based firm.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 24h / self-study56h / group exercise 54h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
Recommended or required reading:
Lecture materials. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
The course utilizes continuous assessment. During the course, the students must write a learning diary for each lecture and participate actively in the lectures. 40% of the grade is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Jaakko Kujala

Working life cooperation:
Group work will be done for a project-based firm or public sector organisation.

Other information:
Timing in academic year 2021-22 is 3rd period.

Process and Quality Management

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>555380S</td>
<td>5.0 op</td>
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ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Contents:
Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
28 h lectures, 106 h independent study on course exercises.
Target group:
Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555286A Process and Quality Management

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS credits.

Language of instruction:
Finnish

Timing:
Periods 1 - 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:
Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:
The tuition will be implemented as blended teaching.

Learning activities and teaching methods:
Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:
Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:
Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
a group exercise related to a process operating in practice.

Other information:

Product Management

555350S: Research and Technology Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
555340S Technology Management 4.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:

• understand the differences between product development and technology management in a company
• piece together the development needs and cycles of technologies in an organisation
combine technology development and technology management with strategic planning of a company

Contents:
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquirement, and transition

Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:

Recommended or required reading:
Lecture materials and articles.

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry

Other information:
Previous course name was 'Technology Management'. Substitutes course 555340S Technology Management.

555351S: Advanced Course in Product Development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
   555345S  Advanced Course in Product Development  6.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the objectives of requirements engineering (RE), design for excellence (DfX) product
design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable
products with minimum product specific investments
- understand requirements engineering process and its key activities, DfX product design concept as
product design guidelines, targets and key performance indicators (KPIs)
- understand DCC process as a sub-process of new product development (NPD) process including
key roles, tasks and milestone criteria
- analyse and further develop RM, DfX and DCC as a part of product development processes

Contents:
The concepts of requirements management, requirements engineering process, requirement prioritisation
and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and
their requirements for product development

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 16 h / group work and self-study 119 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Research and Technology management (Technology
Management).

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Group work, exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Substitutes course 555345S Advanced Course in Product Development.

555343S: Product Data and product life cycle management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.
Language of instruction:
English.
Timing:
Period 3-4.

**Learning outcomes:**
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:
- understand the basic terminology related to product, productisation, PDM and PLM
- analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies
- create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data
- model the company's HW, SW and Service product related commercial and technical product portfolios according to productisation concept
- understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept
- create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

**Contents:**
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

**Learning activities and teaching methods:**
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
555242 Product development

**Recommended optional programme components:**
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

**Recommended or required reading:**
Lecture materials and selected articles.

**Assessment methods and criteria:**
Group work report (50 % of the grade) and exam (50 % of the grade).

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Erno Mustonen

**Working life cooperation:**
The group work will be done in cooperation with case companies.

**Other information:**
Previous course name was 'Product Data Management'.

555346S: Product portfolio management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
**Opattajat:** Erno Mustonen  
**Opintokohteen kielet:** English  
**Voidaan suorittaa useasti:** Kyllä

**Required proficiency level:**

**ECTS Credits:**  
5 ECTS credits.

**Language of instruction:**  
English.

**Timing:**  
Periods 3-4.

**Learning outcomes:**  
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

**Contents:**  
Basic issues in product and product portfolio management performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

**Mode of delivery:**  
The tuition will be implemented as face-to-face learning and practical assignments.

**Learning activities and teaching methods:**  
Will be defined at the beginning of the course.

**Target group:**  
Industrial Engineering and Management and Master’s Programme in Product Management students.

**Prerequisites and co-requisites:**  
555242A Product development, 555350S Technology management.

**Recommended optional programme components:**  
-

**Recommended or required reading:**  
Will be defined at the beginning of the course.

**Assessment methods and criteria:**  
Will be defined at the beginning of the course.

**Grading:**  
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**  
D. Sc. Erno Mustonen
Working life cooperation:
No.

Other information:
Previous course name was ‘Product Management’

Production Management

555330S: Sourcing Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:
555323S Sourcing Management 3.0 op

ETCS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.

Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.

Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 hrs (lectures/ assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

Target group:
Industrial Engineering Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture notes. Other material will be defined at the beginning of the course.
**Assessment methods and criteria:**
The assessment is based on the group work.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Adjunct professor Jukka Majava

**Working life cooperation:**
The group work is done in cooperation with case companies.

**Other information:**
Substitutes course 555323S Sourcing Management.

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**555331S: Advanced Supply Chain Management, 5 op**

Voimassaolo: 01.08.2015 -  
Opiskelumuoto: Advanced Studies  
Laji: Course  
Vastuuysikkö: Field of Industrial Engineering and Management  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Jukka Majava  
Opintokohteen kielet: Finnish  
Leikkaavuudet:  
555324S Advanced Supply Chain Management 3.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish. English material is also used.

**Timing:**
Periods 3-4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management  
- develop and analyse supply networks and create development proposals to improve productivity and competitiveness  
- understand the importance of risk management in supply networks  
- know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

**Contents:**
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

**Mode of delivery:**
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

**Learning activities and teaching methods:**
Face-to-face teaching 16 h (lectures/ group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
- 

**Recommended or required reading:**
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course

**Assessment methods and criteria:**
The grade will be based on the group work (60% of the grade) and book examination (40% of the grade).

**Grading:**
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Associate professor Jukka Majava

**Working life cooperation:**
Case organisations’ supply chain related data is utilised in the group works.

**Other information:**
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**555332S: Operations and supply network analytics, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
555342S Operations Research 5.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English

**Timing:**
Period 4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

**Contents:**
What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).

**Learning activities and teaching methods:**
Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

**Target group:**
Industrial engineering and management students.
Prerequisites and co-requisites:
Bachelor in industrial engineering and management or equivalent.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50%).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
No.

Other information:
Substitutes course 555342S Operations Research.

555333S: Production Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:
555322S Production Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:

- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production

Contents:
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).
Learning activities and teaching methods:
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108 hrs.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

Person responsible:
Yliopistonlehtori Osmo Kauppila

A440260: Complementary Study Module of the Major/ Project Management, Advanced Module, 10 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory studies of Project Management

555391S: Advanced Course in Project Management, 5 op
Learning outcomes:
Upon completion of the course, the student will be able to:
- explain and describe the most important project management areas and tools
- identify and evaluate the most applicable managerial approaches for different types of projects
- identify development needs and opportunities in project-based organisations
- to develop project management processes in an organisation

Contents:
different type of projects and industry specific approaches to project management, agile project management, managing large international projects, project governance, project risk and uncertainty management, project time and schedule management, management of innovative projects.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures, web-based-lectures and workshops 26h, group exercises and cases 66h, self-study 42h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555285A Basic course in project management.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555381S Project Leadership.

555382S: Management of a project-based firm, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jaakko Kujala
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course student will be able to:
- describe the core areas of the management of the project-based firm
- explain how different internal and external contextual factors affect the business of a project-based firm, and how they should be taken account in the design of a business model
- understand the role of services in the business of a project-based firm
- apply systematic approach to project negotiation
- evaluate the significance of a single project for the business of a project based-firm

Contents:
Contextual factors in project business, business model of a project-based firm, integration of services to the business of a project-based firm, project sales and marketing, contracting, project negotiations (negotiation analytic approach) and organising support functions in project-based firm.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 24h / self-study 56h / group exercise 54h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
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Recommended or required reading:
Lecture materials. Other materials will be defined at the beginning of the course.

**Assessment methods and criteria:**
The course utilises continuous assessment. During the course, the students must write a learning diary for each lecture and participate actively in the lectures. 40% of the grade is based on the group work.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Professor Jaakko Kujala

**Working life cooperation:**
Group work will be done for a project-based firm or public sector organisation.

**Other information:**
Timing in academic year 2021-22 is 3rd period.

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**555392S: Change Project and Programme Management, 5 op**

**Voimassaolo:** 01.08.2021 -  
**Opiskelumuoto:** Advanced Studies  
**Laji:** Course  
**Vastuuysikkö:** Field of Industrial Engineering and Management  
**Arvostelu:** 1 - 5, pass, fail  
**Opintokohteen kielet:** English  

Ei opintojakskokuvauksia.

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**E lective advanced studies**

**555376S: Sustainable organisational development, 5 op**

**Voimassaolo:** 01.08.2015 -  
**Opiskelumuoto:** Advanced Studies  
**Laji:** Course  
**Vastuuysikkö:** Field of Industrial Engineering and Management  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Arto Reiman  
**Opintokohteen kielet:** Finnish  
**Leikkaavuudet:**  
555360S Administration, Organization and Education in Working Life 5.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish. English material is also used (the course can be completed in English by the group work and examination).

**Timing:**
Period 1.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- explain the general models regarding sustainable organisational development
- adapt the most central ones to the work organisations
- choose the most suitable models for different situations and can interpret the results gained from different approaches
• explain the most important quantitative and qualitative variables that are either preconditions or results of the operation of the organisation
• identify development needs and opportunities in companies and other organisations.

Contents:
The development of organisation is examined through e.g. the following concepts: productivity, well-being at work, quality control, quality of working life, safety and security, and responsibility. Various concepts and indicators will be discussed, for example, in relation with change processes (e.g. strategy, owner, partnerships, sizes of operations and personnel), implementation, participation, intervention, action research, and learning organisation.

Mode of delivery:
The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:
Face-to-face teaching 18 h (lectures 18 h, exercises and group work 16 h), self-study 100 h).

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555265P Occupational safety and health management, 555264P Managing well-being and quality of working life, 555371S Human resource management.

Recommended optional programme components:
555371S Human resource management, 555370S Strategic management, 555377S Risk Management. Research project in industrial engineering and management related to Organisation and knowledge management topic and Faculty of Education’s Organisational psychology course can be conducted to complement this course.

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment including exercises during the lectures (weight 20 %), group work (weight 50 %) and examination (weight 30 %).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Arto Reiman

Working life cooperation:

Other information:
Previous course name was Organisational Development.
Substitutes course 555360S Administration, Organization and Education in Working Life.

555377S: Risk Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohde: Risk Management

ECTS Sisäkappaleet:

5 ECTS credits.

Opintokohde kieli:

English

Leikkaavuudet:

555321S Risk Management 3.0 op

Learning outcomes:

Upon completion of the course, the student will be able to:

- explain the key concepts of enterprise risk management and uncertainty management
- explain the role of risk management in organisations and compare the specific features of risk management in different organisational contexts
- identify and classify risks and conduct systematic risk analyses in organisations
- make informed improvement suggestions related to enterprise risk management in organisations
- to develop enterprise risk management processes in organisations

Contents:

Definitions of risk and uncertainty, risk management standards, risk classification models, systematic risk management process, methods of risk management, psychological aspects of risk management, ERM and organising of risk management, risk management in different contexts, risk governance.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Face-to-face teaching 26 h (lectures 26h), self-study 42h, group assignment and cases 66 h.

Target group:

Industrial Engineering and Management.

Prerequisites and co-requisites:

B.Sc. in Industrial Engineering and Management or equivalent.

Recommended or required reading:

Lecture materials and reading materials (articles, book chapters) related to each lecture. The materials will be defined at the beginning of the course.

Assessment methods and criteria:

This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Assistant Professor Kirsi Aaltonen
Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555321S Risk Management.

555378S: Seminar in industrial engineering and management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555385S  Advanced Course in Quality Management  5.0 op
  555386S  Advanced Course in Project Management  5.0 op
  555347S  Seminar in Technology Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English.

Timing:
Periods 1-4.

Learning outcomes:
Learning outcomes depend on the content of each seminar. The seminar topics are related to production management, product management, organization and knowledge management, project management, and process and quality management.

Contents:
Will be defined at the beginning of the course.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila
Working life cooperation:

- 

Other information:

555379S: Research Project in Industrial Engineering and Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

- 555367S Exercises in Work Science 6.0 op
- 555387S Project Work in Quality Management 5.0 op
- 555388S Project Work in Project Management 5.0 op
- 555326S Research Project in Production Management 5.0 op
- 555348S Research Project in Technology Management 5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English

Timing:
Periods 1-4 or as summer studies independently

Learning outcomes:
Learning outcomes depend on the project work contents.

Contents:
Project work topics and types vary. The topics are typically related to actual problems in the industry.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
The methods are agreed with the project work instructor. The work can be done individually or in a group.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
The assessment is based on the project work report.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail
Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
The objective of the course is to apply the methods of industrial engineering and management in a company's development activities. The course provides the student with an opportunity to combine and apply his/her existing knowledge in a study project. The student familiarises himself/herself with research work and reporting of the results.

Organisation and knowledge management

555370S: Strategic Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:

555320S Strategic Management 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
- utilise strategic thinking, planning, and management
- analyse and plan complex global business operations
- participate in strategic planning and strategy implementation in organisations
- apply strategy analysis frameworks and analyse the implementation of the chosen strategy

Contents:
Strategic thinking, strategic planning, strategic management, strategy analysis frameworks, strategy implementation with a simulation, analysis of the strategy implementation.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 12 h (lectures 6 h, exercises 6 h), group work 122 h. Alternatively independent learning method: book examination 134 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.
Recommended optional programme components:

- 

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. The group work includes the creation of strategic plan (10 % of the grade), business simulation (30 % of the grade), and the analysis of the strategy (60 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
-

Other information:
Substitutes course 555320S Strategic Management.

555371S: Human Resource Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: English
Leikkaavuudet:
555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of human resource management
- utilise methods in analysing and planning of human resource practices in organisations
- participate in human resource practices planning and implementation in organisations
- apply PCMM (People Capability Maturity Model) frameworks
- know the basic Finnish laws, bylaws and trade agreements in the area of human resource management

Contents:
Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures 10 h, assignment guidance 10 h), group work 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Arto Reiman

Working life cooperation:
The group work is done in cooperation with case companies.

Process and Quality Management

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

<table>
<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>555380S</td>
<td>Quality Management</td>
<td>5.0 op</td>
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ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments
Contents:
Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
28 h lectures, 106 h independent study on course exercises.

Target group:
Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555286A Process and Quality Management

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS credits.
Language of instruction:
Finnish
Timing:
Periods 1 - 2
Learning outcomes:
Upon completion of the course, the student will be able to:
- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:
Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:
The tuition will be implemented as blended teaching.

Learning activities and teaching methods:
Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:
Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:
Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
a group exercise related to a process operating in practice.

Other information:

Product Management

555350S: Research and Technology Management, 5 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
555340S Technology Management 4.0 op

ECTS Credits:
5 ECTS credits.
Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the differences between product development and technology management in a company
- piece together the development needs and cycles of technologies in an organisation
- combine technology development and technology management with strategic planning of a company

Contents:
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquirement, and transition

Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and articles.

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry

Other information:
Previous course name was 'Technology Management'.
Substitutes course 555340S Technology Management.

555351S: Advanced Course in Product Development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Period 2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- understand the objectives of requirements engineering (RE), design for excellence (DfX) product design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable products with minimum product specific investments
- understand requirements engineering process and its key activities, DfX product design concept as product design guidelines, targets and key performance indicators (KPIs)
- understand DCC process as a sub-process of new product development (NPD) process including key roles, tasks and milestone criteria
- analyse and further develop RM, DfX and DCC as a part of product development processes

**Contents:**
The concepts of requirements management, requirements engineering process, requirement prioritisation and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and their requirements for product development

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching.

**Learning activities and teaching methods:**
Lectures 16 h / group work and self-study 119 h.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
555242A Product development, 555350S Research and Technology management (Technology Management).

**Recommended optional programme components:**

**Recommended or required reading:**
Will be defined at the beginning of the course.

**Assessment methods and criteria:**
Group work, exam.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Professor Harri Haapasalo

**Working life cooperation:**
The group work will be done in cooperation with case companies.

**Other information:**
Substitutes course 555345S Advanced Course in Product Development.

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**555343S: Product Data and product life cycle management, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Erno Mustonen

**Opintokohteen kielet:** English
ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3-4.

Learning outcomes:
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:

- understand the basic terminology related to product, productisation, PDM and PLM
- analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies
- create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data
- model the company’s HW, SW and Service product related commercial and technical product portfolios according to productisation concept
- understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept
- create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

Contents:
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

Mode of delivery:
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242 Product development

Recommended optional programme components:
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

Recommended or required reading:
Lecture materials and selected articles.

Assessment methods and criteria:
Group work report (50 % of the grade) and exam (50 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Previous course name was ‘Product Data Management’.
555346S: Product portfolio management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

Required proficiency level:

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 3-4.

Learning outcomes:
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

Contents:
Basic issues in product and product portfolio management performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

Mode of delivery:
The tuition will be implemented as face-to-face learning and practical assignments.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Technology management.

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
No.

Other information:
Previous course name was 'Product Management'

Operations and supply network management

555330S: Sourcing Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:
555323S Sourcing Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.

Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.

Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 hrs (lectures/ assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

Target group:
Industrial Engineering Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**

- 

**Recommended or required reading:**
Lecture notes. Other material will be defined at the beginning of the course

**Assessment methods and criteria:**
The assessment is based on the group work.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Adjunct professor Jukka Majava

**Working life cooperation:**
The group work is done in cooperation with case companies.

**Other information:**
Substitutes course 555323S Sourcing Management.

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**555331S: Advanced Supply Chain Management, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikko:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jukka Majava

**Opintokohteen kiele:** Finnish

**Leikkaavuudet:**

- 555324S Advanced Supply Chain Management 3.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish. English material is also used.

**Timing:**
Periods 3-4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:

- describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management
- develop and analyse supply networks and create development proposals to improve productivity and competitiveness
- understand the importance of risk management in supply networks
- know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

**Contents:**
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

**Mode of delivery:**
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

**Learning activities and teaching methods:**
Face-to-face teaching 16 h (lectures/group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
-

**Recommended or required reading:**
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course

**Assessment methods and criteria:**
The grade will be based on the group work (60% of the grade) and book examination (40% of the grade).

**Grading:**
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Associate professor Jukka Majava

**Working life cooperation:**
Case organisations' supply chain related data is utilised in the group works.

**Other information:**
-

555332S: Operations and supply network analytics, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**

555342S Operations Research 5.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English

**Timing:**
Period 4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:

- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

**Contents:**
What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).
Learning activities and teaching methods:
Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

Target group:
Industrial engineering and management students.

Prerequisites and co-requisites:
Bachelor in industrial engineering and management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50%).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
No.

Other information:
Substitutes course 555342S Operations Research.

555333S: Production Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:
555322S Production Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production
Contents:
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108 hrs.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.

555308M: Advanced Studies of the Majors in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

Person responsible:
Yliopistonlehtori Osmo Kauppila

A440261: Complementary Study Module of the Major/ Process and Quality Management, Advanced Module, 15 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Obligatory studies of Process and Quality Management

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555380S  Quality Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Contents:
Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
28 h lectures, 106 h independent study on course exercises.

Target group:
Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555286A Process and Quality Management

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University lecturer Osmo Kauppila.

**Working life cooperation:**
No.

**Other information:**
Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

**Voimassaolo:** 01.08.2013 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Osmo Kauppila
**Opintokohteen kielet:** Finnish

**ECTS Credits:**
10 ECTS credits.

**Language of instruction:**
Finnish

**Timing:**
Periods 1 - 2

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

**Contents:**
Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

**Mode of delivery:**
The tuition will be implemented as blended teaching.

**Learning activities and teaching methods:**
Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

**Target group:**
Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

**Prerequisites and co-requisites:**
Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

**Recommended optional programme components:**
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**Recommended or required reading:**
Assessment methods and criteria:
To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
a group exercise related to a process operating in practice.

Other information:

Elective advanced studies

555376S: Sustainable organisational development, 5 op

Voimassaajo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: Finnish
Leikkaavuudet:

555360S Administration, Organization and Education in Working Life 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used (the course can be completed in English by the group work and examination).

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the general models regarding sustainable organisational development
- adapt the most central ones to the work organisations
- choose the most suitable models for different situations and can interpret the results gained from different approaches
- explain the most important quantitative and qualitative variables that are either preconditions or results of the operation of the organisation
- identify development needs and opportunities in companies and other organisations.

Contents:
The development of organisation is examined through e.g. the following concepts: productivity, well-being at work, quality control, quality of working life, safety and security, and responsibility. Various concepts and indicators will be discussed, for example, in relation with change processes (e.g. strategy, owner, partnerships, sizes of operations and personnel), implementation, participation, intervention, action research, and learning organisation.

Mode of delivery:
The tuition will be implemented as web-based teaching.
Learning activities and teaching methods:
Face-to-face teaching 18 h (lectures 18 h, exercises and group work 16 h), self-study 100 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555265P Occupational safety and health management, 555264P Managing well-being and quality of working life, 555371S Human resource management.

Recommended optional programme components:
555371S Human resource management, 555370S Strategic management, 555377S Risk Management. Research project in industrial engineering and management related to Organisation and knowledge management topic and Faculty of Education’s Organisational psychology course can be conducted to complement this course.

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment including exercises during the lectures (weight 20 %), group work (weight 50 %) and examination (weight 30 %).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Arto Reiman

Working life cooperation:
-

Other information:
Previous course name was Organisational Development.
Substitutes course 555360S Administration, Organization and Education in Working Life.

555377S: Risk Management, 5 op

Voimassaolo: 01.08.2015 - 
Opiskelmuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:
  555321S   Risk Management   3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English
Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the key concepts of enterprise risk management and uncertainty management
- explain the role of risk management in organisations and compare the specific features of risk management in different organisational contexts
- identify and classify risks and conduct systematic risk analyses in organisations
- make informed improvement suggestions related to enterprise risk management in organisations
- to develop enterprise risk management processes in organisations

Contents:
Definitions of risk and uncertainty, risk management standards, risk classification models, systematic risk management process, methods of risk management, psychological aspects of risk management, ERM and organising of risk management, risk management in different contexts, risk governance.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 26 h (lectures 26h), self-study 42h, group assignment and cases 66 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture. The materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant Professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555321S Risk Management.

555378S: Seminar in industrial engineering and management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

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ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English.

Timing:
Periods 1-4.

Learning outcomes:
Learning outcomes depend on the content of each seminar. The seminar topics are related to production management, product management, organization and knowledge management, project management, and process and quality management.

Contents:
Will be defined at the beginning of the course.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:

Other information:

555379S: Research Project in Industrial Engineering and Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
- 555367S Exercises in Work Science 6.0 op
- 555387S Project Work in Quality Management 5.0 op
- 555388S Project Work in Project Management 5.0 op
- 555326S Research Project in Production Management 5.0 op
- 555348S Research Project in Technology Management 5.0 op
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.
Language of instruction:
Finnish/English
Timing:
Periods 1-4 or as summer studies independently
Learning outcomes:
Learning outcomes depend on the project work contents.
Contents:
Project work topics and types vary. The topics are typically related to actual problems in the industry.
Mode of delivery:
Will be defined at the beginning of the course.
Learning activities and teaching methods:
The methods are agreed with the project work instructor. The work can be done individually or in a group.
Target group:
Industrial Engineering and Management students.
Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.
Recommended optional programme components:
-
Recommended or required reading:
Will be defined at the beginning of the course.
Assessment methods and criteria:
The assessment is based on the project work report.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail
Person responsible:
University lecturer Osmo Kauppila
Working life cooperation:
-
Other information:
The objective of the course is to apply the methods of industrial engineering and management in a company’s development activities. The course provides the student with an opportunity to combine and apply his/her existing knowledge in a study project. The student familiarises himself/herself with research work and reporting of the results.

Project Management

555391S: Advanced Course in Project Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:
555381S  Project Leadership  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain and describe the most important project management areas and tools
- identify and evaluate the most applicable managerial approaches for different types of projects
- identify development needs and opportunities in project-based organisations
- to develop project management processes in an organisation

Contents:
different type of projects and industry specific approaches to project management, agile project management, managing large international projects, project governance, project risk and uncertainty management, project time and schedule management, management of innovative projects.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures, web-based-lectures and workshops 26h, group exercises and cases 66h, self-study 42h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555285A Basic course in project management.

Recommended optional programme components:
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Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555381S Project Leadership.

555382S: Management of a project-based firm, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jaakko Kujala
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course student will be able to:
- describe the core areas of the management of the project-based firm
- explain how different internal and external contextual factors affect the business of a project-based firm, and how they should be taken account in the design of a business model
- understand the role of services in the business of a project-based firm
- apply systematic approach to project negotiation
- evaluate the significance of a single project for the business of a project based-firm

Contents:
Contextual factors in project business, business model of a project-based firm, integration of services to the business of a project-based firm, project sales and marketing, contracting, project negotiations (negotiation analytic approach) and organising support functions in project-based firm.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 24h / self-study 56h / group exercise 54h
Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
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Recommended or required reading:
Lecture materials. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
The course utilises continuous assessment. During the course, the students must write a learning diary for each lecture and participate actively in the lectures. 40% of the grade is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Jaakko Kujala

Working life cooperation:
Group work will be done for a project-based firm or public sector organisation.

Other information:
Timing in academic year 2021-22 is 3rd period.

Organisation and knowledge management

555370S: Strategic Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:

555320S Strategic Management 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
- utilise strategic thinking, planning, and management
- analyse and plan complex global business operations
- participate in strategic planning and strategy implementation in organisations
- apply strategy analysis frameworks and analyse the implementation of the chosen strategy

Contents:
Strategic thinking, strategic planning, strategic management, strategy analysis frameworks, strategy implementation with a simulation, analysis of the strategy implementation.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).
Learning activities and teaching methods:
Face-to-face teaching 12 h (lectures 6 h, exercises 6 h), group work 122 h. Alternatively independent learning method: book examination 134 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. The group work includes the creation of strategic plan (10 % of the grade), business simulation (30 % of the grade), and the analysis of the strategy (60 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:

Other information:
Substitutes course 555320S Strategic Management.

555371S: Human Resource Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Arto Reiman
Opintokohteen kielet: English
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:

- understand the key concepts of human resource management
- utilise methods in analysing and planning of human resource practices in organisations
- participate in human resource practices planning and implementation in organisations
- apply PCMM (People Capability Maturity Model) frameworks
• know the basic Finnish laws, bylaws and trade agreements in the area of human resource management

Contents:

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures 10 h, assignment guidance 10 h), group work 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
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Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Arto Reiman

Working life cooperation:
The group work is done in cooperation with case companies.

Production Management

555330S: Sourcing Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555323S  Sourcing Management  3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.
Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.

Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 hrs (lectures/ assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

Target group:
Industrial Engineering Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
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Recommended or required reading:
Lecture notes. Other material will be defined at the beginning of the course

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555323S Sourcing Management.

555331S: Advanced Supply Chain Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

**Language of instruction:**
Finnish. English material is also used.

**Timing:**
Periods 3-4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management
- develop and analyse supply networks and create development proposals to improve productivity and competitiveness
- understand the importance of risk management in supply networks
- know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

**Contents:**
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

**Mode of delivery:**
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

**Learning activities and teaching methods:**
Face-to-face teaching 16 h (lectures/ group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
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**Recommended or required reading:**
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course

**Assessment methods and criteria:**
The grade will be based on the group work (60 % of the grade) and book examination (40 % of the grade).

**Grading:**
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Associate professor Jukka Majava

**Working life cooperation:**
Case organisations’ supply chain related data is utilised in the group works.

**Other information:**
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**555332S: Operations and supply network analytics, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuyksikkö:** Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

Contents:
What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).

Learning activities and teaching methods:
Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

Target group:
Industrial engineering and management students.

Prerequisites and co-requisites:
Bachelor in industrial engineering and management or equivalent.

Recommended optional programme components:
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Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50%).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
No.

Other information:
Substitutes course 555342S Operations Research.

555333S: Production Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kieleet: English
Leikkaavuudet:

555322S Production Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production

Contents:
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108 hrs.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
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Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.
555350S: Research and Technology Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
  555340S  Technology Management  4.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the differences between product development and technology management in a company
- piece together the development needs and cycles of technologies in an organisation
- combine technology development and technology management with strategic planning of a company

Contents:
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquirement, and transition

Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:
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Recommended or required reading:
Lecture materials and articles.

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry
Other information:
Previous course name was 'Technology Management'.
Substitutes course 555340S Technology Management.

555351S: Advanced Course in Product Development, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:

555345S Advanced Course in Product Development 6.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:

- understand the objectives of requirements engineering (RE), design for excellence (DfX) product design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable products with minimum product specific investments
- understand requirements engineering process and its key activities, DfX product design concept as product design guidelines, targets and key performance indicators (KPIs)
- understand DCC process as a sub-process of new product development (NPD) process including key roles, tasks and milestone criteria
- analyse and further develop RM, DfX and DCC as a part of product development processes

Contents:
The concepts of requirements management, requirements engineering process, requirement prioritisation and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and their requirements for product development

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 16 h / group work and self-study 119 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555242A Product development, 555350S Research and Technology management (Technology Management).

Recommended optional programme components:

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Group work, exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Professor Harri Haapasalo

**Working life cooperation:**
The group work will be done in cooperation with case companies.

**Other information:**
Substitutes course 555345S Advanced Course in Product Development.

555343S: Product Data and product life cycle management, 5 op

- **Opiskelumuoto:** Advanced Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Erno Mustonen
- **Opintokohteen kielet:** English
- **Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Period 3-4.

**Learning outcomes:**
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:

- understand the basic terminology related to product, productisation, PDM and PLM
- analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies
- create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data
- model the company's HW, SW and Service product related commercial and technical product portfolios according to productisation concept
- understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept
- create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

**Contents:**
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

**Learning activities and teaching methods:**
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
Recommended optional programme components:
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

Recommended or required reading:
Lecture materials and selected articles.

Assessment methods and criteria:
Group work report (50 % of the grade) and exam (50 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Erno Mustonen

Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Previous course name was 'Product Data Management'.

555346S: Product portfolio management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

Required proficiency level:

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 3-4.

Learning outcomes:
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

Contents:
Basic issues in product and product portfolio management performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

Mode of delivery:
The tuition will be implemented as face-to-face learning and practical assignments.

**Learning activities and teaching methods:**
Will be defined at the beginning of the course.

**Target group:**
Industrial Engineering and Management and Master’s Programme in Product Management students.

**Prerequisites and co-requisites:**
555242A Product development, 555350S Technology management.

**Recommended optional programme components:**
-

**Recommended or required reading:**
Will be defined at the beginning of the course.

**Assessment methods and criteria:**
Will be defined at the beginning of the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Erno Mustonen

**Working life cooperation:**
No.

**Other information:**
Previous course name was ‘Product Management’

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**A440270: Complementary Module, Other Industrial Engineering and Management Studies, 20 - 30 op**

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

*Elective studies (max 10 cr)*

**555226A: Operations and supply chain management, 5 op**

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Farzad Pargar
Opintokohteen kielet: English
Leikkaavuudet:

555222A Demonstration in Industrial Engineering and Management 2.0 op
555223A Introduction to Production Control 3.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

English.

Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course, the student will be able to:

- describe different production types
- apply different forecasting methods, plan needed production capacity, and apply location and transportation decisions related methods
- master common inventory management methods and aggregated and short-term scheduling
- create a sales and operations plan for a company

Contents:

Production types, forecasting methods, capacity planning and queuing models, location and transportation decisions, inventory management systems, aggregate scheduling, MRP & ERP, short-term scheduling, linear programming.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Lectures 16 hours / independent studying 64 hours.

Target group:

Industrial Engineering and Management students.

Prerequisites and co-requisites:

555225P Basics of industrial engineering and management or similar knowledge.

Recommended optional programme components:

Industrial Engineering and Management students will complete 902143Y Company presentations course simultaneously.

Recommended or required reading:


Assessment methods and criteria:

This course utilises continuous assessment. During the course, there are mandatory weekly assignments. At least half of the assignments must be passed. 40 % of the grade is based on the group work.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Post-doctoral researcher Farzad Pargar.

Working life cooperation:

The group work will be done for a real company by using public information sources.

Other information:

Substitutes course 555222A Demonstration in Industrial Engineering and Management 2 ECTS cr and 555223A Introduction to Production Control 3 ECTS cr.

Previous course name was 'Operations and Production'.
555242A: Product development, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
ay555242A Product development (OPEN UNI) 5.0 op
555240A Basic Course in Product Development 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Periods 1-2.

Learning outcomes:
This course introduces product development and innovations management in a company environment. The course provides fundamental understanding over tools and frameworks that can be used for analysing and managing products, innovations, and technology development. The aim is to create a connection between product development and other company functions. Upon completion of the course, the student will be able to

- explain the role of product development as a company function
- understand the difference between innovation activities and systematic product development, and knows the difference between different phases of product development process and its activities
- transform customer needs into requirements for product development process and finally into product features
- define the meaning of other company functions to product development activities

Contents:
Meaning of products for the operations of an industrial enterprise, product development paradigm and defining relevant concepts, realising product development methodologically (U&E model, Cooper's stage-gate model, QFD), managing innovations, and product development success factors.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 20 h / exercises 6 h / group work and self-study 108 h.

Target group:
Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555226A Operations and supply chain management (Operations and production)

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Assessment methods and criteria:
Exam and group work.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Professor Harri Haapasalo.

**Working life cooperation:**
No.

**Other information:**
Substitutes course 555240A Basic Course in Product Development.

555285A: Project management, 5 op

**Voimassaolo:** 01.01.2014 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 555288A Project Management 5.0 op
- ay555285A Project management (OPEN UNI) 5.0 op
- 555282A Project Management 4.0 op
- 555280P Basic Course of Project Management 2.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish. Check the course in English 555288A Project Management.

**Timing:**
Period 2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- describe explain the essential concepts and methods related to project management
- apply project management methods to create a schedule for a project and calculate critical path
- understand essential concepts related to project cost management and able to apply earned value method and three point estimate to manage project costs
- recognises the essential tasks of project risk management

**Contents:**
Defining project management, project goals and objectives, project phases and project life-cycle management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management, project stakeholder management, project communications management, the role of project manager, new modes of project delivery

**Mode of delivery:**
The tuition will be implemented as web-based teaching.

**Learning activities and teaching methods:**
Web-based lectures 16h, self-study 118h

**Target group:**
Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
No prerequisites exist.

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:
Lecture material, exercise book, Artto, Martinsuo & Kujala 2006. Projektiliketoiminta. WSOY

Assessment methods and criteria:
Weekly assignments and final online exam

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
Videos from the industry’s projects

Other information:
Substitutes courses 555280P Basic Course of Project Management + 555282A Project Management.

555286A: Process and quality management, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay555286A Process and quality management (OPEN UNI) 5.0 op
555281A Basic Course of Quality Management 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the role of process and quality management in a business organisation
- develop business processes based on the principles of quality management and appropriate tool
Contents:
Foundations of total quality management, planning of quality, performance measurement, process
management, people management in relation to quality management, implantation of total quality
management.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
20 h lectures, 114 h independent study

Target group:
Industrial Engineering and Management students and other students studying Industrial Engineering and
Management as minor.

Prerequisites and co-requisites:
-

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes
555225P Basics of industrial engineering and management, 555285A Project management, 555242A
Product development, and 555264P Managing well-being and quality of working life.

Recommended or required reading:
and material handed out during the course.

Assessment methods and criteria:
To pass the course, the student must pass the weekly course exercises (50 % of the course grade) and an
exam (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555281A Basic Course of Quality Management.

Elective advanced studies

555377S: Risk Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Kirsi Aaltonen
Opintokohteen kielet: English
Leikkaavuudet:
  555321S  Risk Management  3.0 op

ECTS Credits:
5 ECTS credits.
Language of instruction:
English

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the key concepts of enterprise risk management and uncertainty management
- explain the role of risk management in organisations and compare the specific features of risk management in different organisational contexts
- identify and classify risks and conduct systematic risk analyses in organisations
- make informed improvement suggestions related to enterprise risk management in organisations
- develop enterprise risk management processes in organisations

Contents:
Definitions of risk and uncertainty, risk management standards, risk classification models, systematic risk management process, methods of risk management, psychological aspects of risk management, ERM and organising of risk management, risk management in different contexts, risk governance.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 26 h (lectures 26h), self-study 42h, group assignment and cases 66 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
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Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture. The materials will be defined at the beginning of the course.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant Professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555321S Risk Management.
Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the general models regarding sustainable organisational development
- adapt the most central ones to the work organisations
- choose the most suitable models for different situations and can interpret the results gained from different approaches
- explain the most important quantitative and qualitative variables that are either preconditions or results of the operation of the organisation
- identify development needs and opportunities in companies and other organisations.

Contents:
The development of organisation is examined through e.g. the following concepts: productivity, well-being at work, quality control, quality of working life, safety and security, and responsibility. Various concepts and indicators will be discussed, for example, in relation with change processes (e.g. strategy, owner, partnerships, sizes of operations and personnel), implementation, participation, intervention, action research, and learning organisation.

Mode of delivery:
The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:
Face-to-face teaching 18 h (lectures 18 h, exercises and group work 16 h), self-study 100 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555265P Occupational safety and health management, 555264P Managing well-being and quality of working life, 555371S Human resource management.

Recommended optional programme components:
555371S Human resource management, 555370S Strategic management, 555377S Risk Management. Research project in industrial engineering and management related to Organisation and knowledge management topic and Faculty of Education’s Organisational psychology course can be conducted to complement this course.

Recommended or required reading:
Assessment methods and criteria:
This course utilises continuous assessment including exercises during the lectures (weight 20 %), group work (weight 50 %) and examination (weight 30 %).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
D. Sc. Arto Reiman

Working life cooperation:
-

Other information:
Previous course name was Organisational Development.
Substitutes course 555360S Administration, Organization and Education in Working Life.

555378S: Seminar in industrial engineering and management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555385S Advanced Course in Quality Management  5.0 op
  555386S Advanced Course in Project Management  5.0 op
  555347S Seminar in Technology Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish/English.

Timing:
Periods 1-4.

Learning outcomes:
Learning outcomes depend on the content of each seminar. The seminar topics are related to production management, product management, organization and knowledge management, project management, and process and quality management.

Contents:
Will be defined at the beginning of the course.

Mode of delivery:
Will be defined at the beginning of the course.

Learning activities and teaching methods:
Will be defined at the beginning of the course.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
- 

**Recommended or required reading:**
Will be defined at the beginning of the course.

**Assessment methods and criteria:**
Will be defined at the beginning of the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University lecturer Osmo Kauppila

**Working life cooperation:**
- 

**Other information:**

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**555379S: Research Project in Industrial Engineering and Management, 5 op**

**Voimassaolo:** 01.08.2015 - 

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Osmo Kauppila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 555367S Exercises in Work Science 6.0 op
- 555387S Project Work in Quality Management 5.0 op
- 555388S Project Work in Project Management 5.0 op
- 555326S Research Project in Production Management 5.0 op
- 555348S Research Project in Technology Management 5.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
Finnish/English

**Timing:**
Periods 1-4 or as summer studies independently

**Learning outcomes:**
Learning outcomes depend on the project work contents.

**Contents:**
Project work topics and types vary. The topics are typically related to actual problems in the industry.

**Mode of delivery:**
Will be defined at the beginning of the course.

**Learning activities and teaching methods:**
The methods are agreed with the project work instructor. The work can be done individually or in a group.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent.

**Recommended optional programme components:**
- 

**Recommended or required reading:**
Will be defined at the beginning of the course.

**Assessment methods and criteria:**
The assessment is based on the project work report.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

**Person responsible:**
University lecturer Osmo Kauppila

**Working life cooperation:**
- 

**Other information:**
The objective of the course is to apply the methods of industrial engineering and management in a company’s development activities. The course provides the student with an opportunity to combine and apply his/her existing knowledge in a study project. The student familiarises himself/herself with research work and reporting of the results.


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**Project Management**

**555391S: Advanced Course in Project Management, 5 op**

- **Voimassaolo:** 01.08.2015 -
- **Opiskelumuoto:** Advanced Studies
- **Laji:** Course
- **Vastuuyksikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Kirsi Aaltonen
- **Opintokohteen kielet:** English
- **Leikkaavuudet:**
  - 555381S Project Leadership 5.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Periods 1-2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- explain and describe the most important project management areas and tools
- identify and evaluate the most applicable managerial approaches for different types of projects
identify development needs and opportunities in project-based organisations to develop project management processes in an organisation

Contents:
different type of projects and industry specific approaches to project management, agile project management, managing large international projects, project governance, project risk and uncertainty management, project time and schedule management, management of innovative projects.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Lectures, web-based-lectures and workshops 26h, group exercises and cases 66h, self-study 42h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555285A Basic course in project management.

Recommended optional programme components:

Recommended or required reading:
Lecture materials and reading materials (articles, book chapters) related to each lecture.

Assessment methods and criteria:
This course utilises continuous assessment. The grading is based on case assignments solved in groups and discussed during the lecture, and group assignment that is presented and discussed in the workshops. Since the implementation of the cases and group work vary, the assessment methods and criteria will be defined at the beginning of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
The course includes guest lectures from industry.

Other information:
Substitutes course 555381S Project Leadership.

555382S: Management of a project-based firm, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jaakko Kujala
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.
Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
Upon completion of the course student will be able to:

- describe the core areas of the management of the project-based firm
- explain how different internal and external contextual factors affect the business of a project-based firm, and how they should be taken account in the design of a business model
- understand the role of services in the business of a project-based firm
- apply systematic approach to project negotiation
- evaluate the significance of a single project for the business of a project based-firm

Contents:
Contextual factors in project business, business model of a project-based firm, integration of services to the business of a project-based firm, project sales and marketing, contracting, project negotiations (negotiation analytic approach) and organising support functions in project-based firm.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 24h / self-study56h / group exercise 54h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture materials. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:
The course utilises continuous assessment. During the course, the students must write a learning diary for each lecture and participate actively in the lectures. 40% of the grade is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Jaakko Kujala

Working life cooperation:
Group work will be done for a project-based firm or public sector organisation.

Other information:
Timing in academic year 2021-22 is 3rd period.

Organization and knowledge management

555370S: Strategic Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:
555320S Strategic Management 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3.

Learning outcomes:
Upon completion of the course, the student will be able to:
- utilise strategic thinking, planning, and management
- analyse and plan complex global business operations
- participate in strategic planning and strategy implementation in organisations
- apply strategy analysis frameworks and analyse the implementation of the chosen strategy

Contents:
Strategic thinking, strategic planning, strategic management, strategy analysis frameworks, strategy implementation with a simulation, analysis of the strategy implementation.

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 12 h (lectures 6 h, exercises 6 h), group work 122 h. Alternatively independent learning method: book examination 134 h.

Target group:
Industrial Engineering and Management.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
This course utilises continuous assessment. The group work includes the creation of strategic plan (10 % of the grade), business simulation (30 % of the grade), and the analysis of the strategy (60 % of the grade).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
-

Other information:
Substitutes course 555320S Strategic Management.

555371S: Human Resource Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of human resource management
- utilise methods in analysing and planning of human resource practices in organisations
- participate in human resource practices planning and implementation in organisations
- apply PCMM (People Capability Maturity Model) frameworks
- know the basic Finnish laws, bylaws and trade agreements in the area of human resource management

Contents:

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 h (lectures 10 h, assignment guidance 10 h), group work 114 h.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Arto Reiman

Working life cooperation:
The group work is done in cooperation with case companies.
Process and Quality Management

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555380S  Quality Management  5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish.

Timing:
Period 1.

Learning outcomes:
Upon completion of the course, the student will be able to:
- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Contents:
Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:
28 h lectures, 106 h independent study on course exercises.

Target group:
Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
555286A Process and Quality Management

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
No.

Other information:
Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS credits.

Language of instruction:
Finnish

Timing:
Periods 1 - 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:
Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:
The tuition will be implemented as blended teaching.

Learning activities and teaching methods:
Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:
Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:
Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:
-

Recommended or required reading:
Assessment methods and criteria:
To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila.

Working life cooperation:
a group exercise related to a process operating in practice.

Other information:

Product Management

555350S: Research and Technology Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:

- understand the differences between product development and technology management in a company
- piece together the development needs and cycles of technologies in an organisation
- combine technology development and technology management with strategic planning of a company

Contents:
Defining technology and its role within an enterprise and within society, the meaning of innovation in technological competition, the lifecycles of technology including development, acquirement, and transition

Mode of delivery:
The tuition will be implemented as face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 20 h, group work and self-study 115 h.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
555242A Product Development.

Recommended optional programme components:
Recommended or required reading:
Lecture materials and articles.

Assessment methods and criteria:
Exam and group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
Visitor lecturers from the industry

Other information:
Previous course name was 'Technology Management'.
Substitutes course 555340S Technology Management.

555351S: Advanced Course in Product Development, 5 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Haapasalo, Harri Jouni Olavi
Opintokohteen kielet: English
Leikkaavuudet:
   555345S Advanced Course in Product Development  6.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the objectives of requirements engineering (RE), design for excellence (DfX) product design concept and delivery capability creation (DCC) in order to develop and ramp up sustainable products with minimum product specific investments
- understand requirements engineering process and its key activities, DfX product design concept as product design guidelines, targets and key performance indicators (KPIs)
- understand DCC process as a sub-process of new product development (NPD) process including key roles, tasks and milestone criteria
- analyse and further develop RM, DfX and DCC as a part of product development processes

Contents:
The concepts of requirements management, requirements engineering process, requirement prioritisation and valuation, Design for Excellence (DfX), delivery capability creation (DCC), different stakeholders and their requirements for product development

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 16 h / group work and self-study 119 h.

Target group:
Industrial Engineering and Management students.
Prerequisites and co-requisites:
555242A Product development, 555350S Research and Technology management (Technology Management).

Recommended optional programme components:
-

Recommended or required reading:
Will be defined at the beginning of the course.

Assessment methods and criteria:
Group work, exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Professor Harri Haapasalo

Working life cooperation:
The group work will be done in cooperation with case companies.

Other information:
Substitutes course 555345S Advanced Course in Product Development.

555343S: Product Data and product life cycle management, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Erno Mustonen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
Period 3-4.

Learning outcomes:
The course familiarises students with the broad concepts of product data management (PDM) and product life cycle management (PLM). Upon completion of the course, the student will be able to:
- understand the basic terminology related to product, productisation, PDM and PLM
- analyse the current status of the productisation, product data structures, product life cycle management, commercial and technical product portfolios and related applications in case companies
- create strategic PDM and PLM concept based on the critical building blocks for one product data, product master data and product related business data
- model the company's HW, SW and Service product related commercial and technical product portfolios according to productisation concept
- understand the PDM and PLM processes including key roles such as concept owners, education and support roles, data owners, data users including the product data quality concept
- create and implement the governance model for PDM and PLM process and IT development as a part of company’s business process development including PDM/PLM related information technology (IT) architecture for product master data and product related business data

Contents:
PDM and PLM strategic targets, productisation concept, commercial and technical product portfolios, PDM and PLM processes and tools, governance model and related IT applications and architecture

**Mode of delivery:**
The tuition will be implemented as face-to-face teaching, course readings and by a practical assignment which is a common with a course 555346S Product portfolio management.

**Learning activities and teaching methods:**
Face-to-face teaching 20 h (lectures), practical assignment (group work) and self-study 114 h.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
555242 Product development

**Recommended optional programme components:**
555350S Research and technology management, 555351S Advanced course in product development, 555346S Product portfolio management

**Recommended or required reading:**
Lecture materials and selected articles.

**Assessment methods and criteria:**
Group work report (50 % of the grade) and exam (50 % of the grade).

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Erno Mustonen

**Working life cooperation:**
The group work will be done in cooperation with case companies.

**Other information:**
Previous course name was 'Product Data Management'.

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555346S: Product portfolio management, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Erno Mustonen

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

**Required proficiency level:**

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
Periods 3-4.

**Learning outcomes:**
The course familiarizes students with the broad concepts of product management. After finishing the course, the student understands central principles and contents of product management and product portfolio management. Student knows the basic steps of the product portfolio management development and understands the ways to analyse and manage products and product portfolios. A student learns to see product and product portfolio management as strategic targets, performance indicators, governance models, process and product information management over horizontal and technical portfolios over product life cycle phases and product structure levels. The student can apply the learned things and methods in different industries in order to develop systematic product and product portfolio management processes.

**Contents:**
Basic issues in product and product portfolio management performance management, governance models, horizontal and vertical portfolios, processes, tools and product information.

**Mode of delivery:**
The tuition will be implemented as face-to-face learning and practical assignments.

**Learning activities and teaching methods:**
Will be defined at the beginning of the course.

**Target group:**
Industrial Engineering and Management and Master’s Programme in Product Management students.

**Prerequisites and co-requisites:**
555242A Product development, 555350S Technology management.

**Recommended optional programme components:**

**Recommended or required reading:**
Will be defined at the beginning of the course.

**Assessment methods and criteria:**
Will be defined at the beginning of the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
D. Sc. Erno Mustonen

**Working life cooperation:**
No.

**Other information:**
Previous course name was ‘Product Management’

*Production Management*

**555330S: Sourcing Management, 5 op**

*Voimassaolo:* 01.08.2015 -
*Opiskelumuoto:* Advanced Studies
*Laji:* Course
*Vastuuysikkö:* Field of Industrial Engineering and Management
*Arvostelu:* 1 - 5, pass, fail
*Opettajat:* Jukka Majava
*Opintokohteen kielet:* Finnish
*Leikkaavuudet:*
ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material will also be used.

Timing:
Period 2

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the overall concept of sourcing management
- know the key concepts of sourcing and purchase management and can explain these
- describe the structures of sourcing and purchasing organisations and can explain the meaning of sourcing management in the performance of operations
- analyse the purchasing activities in a company and can produce improvement proposals based on the analysis
- take part in the sourcing development in the role of an expert.

Contents:
Purchasing operations in a manufacturing company, the principles of the sourcing and purchasing strategy and practices, suppliers and products, IT systems for sourcing and purchase.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 20 hrs (lectures/ assignment guidance 14 hrs, final seminar 6 hrs) group work 114 hrs.

Target group:
Industrial Engineering Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Lecture notes. Other material will be defined at the beginning of the course

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555323S Sourcing Management.

555331S: Advanced Supply Chain Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:
555324S Advanced Supply Chain Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used.

Timing:
Periods 3-4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- describe supply chain and supply chain management concepts and strategies, as well as understand the importance of effective supply chain management
- develop and analyse supply networks and create development proposals to improve productivity and competitiveness
- understand the importance of risk management in supply networks
- know the importance of sustainability and social responsibility and the opportunities of digitalisation in supply network development

Contents:
supply chain and supply chain management concepts and processes, supply chain strategies, performance measurement, supply network development, risk management and resilience, demand and supply planning and coordination, inventory management, transportation, information systems, social responsibility and sustainable development

Mode of delivery:
The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:
Face-to-face teaching 16 h (lectures/ group work presentations 12 h, exercises 4 h), group work 64 h, self-study 54 h

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
Sakki, J. (2014) Tilaus-toimitusketjun hallinta. Jouni Sakki Oy. Other materials will be provided at the beginning of the course

Assessment methods and criteria:
The grade will be based on the group work (60 % of the grade) and book examination (40 % of the grade).

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Associate professor Jukka Majava

Working life cooperation:
Case organisations’ supply chain related data is utilised in the group works.

Other information:
-
555332S: Operations and supply network analytics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555342S Operations Research 5.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Period 4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the basic concepts of operations research and its applications in operations and production activities and decision-making in companies
- apply quantitative methods typical to the field of operations research in practical problem solving

Contents:
What is operations research, linear and dynamic programming, network and transportation algorithms, decision analysis, inventory models, queueing systems, simulation modeling.

Mode of delivery:
The tuition will be implemented as face-to-face teaching (lectures, classroom exercises and group work).

Learning activities and teaching methods:
Face-to-face teaching 40 h (Lectures 20 h, classroom exercises 20 h), independent study and group work 96 h.

Target group:
Industrial engineering and management students.

Prerequisites and co-requisites:
Bachelor in industrial engineering and management or equivalent.

Recommended optional programme components:

Recommended or required reading:

Assessment methods and criteria:
To pass the course, the student must complete the required coursework consisting of the exercises handed out during the classroom study (50%) and a compilation of analytics exercises that can be done in groups (50 %).

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
No.
555333S: Production Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:
555322S Production Management 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
English

Timing:
Periods 1-2.

Learning outcomes:
Upon completion of the course, the student will be able to:
- understand the key concepts of operations and production management
- know the essential production strategies
- understand the principles of the supply chain management, and should be able to apply JIT, Lean
  and TOC methods in analysing and constructing development plans for production organisations
- apply the management methods also in service systems
- understand the principles of the sustainable development in production

Contents:
Production strategies, sustainable development, Supply Chain Management, Just-In-Time (JIT), Theory of
Constraints (TOC), Lean, Toyota Production System (TPS), management of the production of services.

Mode of delivery:
The tuition will be implemented as blended teaching (face-to-face teaching and a supervised group work).

Learning activities and teaching methods:
Face-to-face teaching 26 hrs (lectures/assignment guidance 20 hrs, final seminar 6 hrs), group work 108
hrs.

Target group:
Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:
B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:
-

Recommended or required reading:
lectures.

Assessment methods and criteria:
The assessment is based on the group work.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Adjunct professor Jukka Majava

Working life cooperation:
The group work is done in cooperation with case companies.

Other information:
Substitutes course 555322S Production Management.

555309M: Supplementary Studies of the Majors in other Universities /Institutes, 0 - 60 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

A440253: Supplementary Module, Electrical Engineering, 20 - 30 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Electronics

521432A: Electronics Design I, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Learning outcomes:
1. should be able to recount the principles covering the design of multistage amplifiers
2. should be able to analyze and set the frequency response of a transistor amplifier
3. should be able to make use of feedback to improve the properties of an amplifier in the desired manner
4. should be able to analyze the stability of a given degree of feedback amplification and to dimension an amplifier correctly to ensure stability
5. should be able to describe the principles governing the design of power amplifiers
6. should be able to make widespread use of operational amplifiers for realizing electronic circuits and to take account of the limitations imposed by the non-idealities inherent in operational amplifiers
7. should be able to design low-frequency oscillators, to explain the operating principles of radio frequency oscillators and tuned amplifiers

Contents:
Frequency response of a transistor amplifier, differential amplifier, feedback, power amplifiers, oscillators and tuned amplifiers, non-idealities of an operational amplifier, applications of operational amplifiers.

Mode of delivery:
Remote teaching.

Learning activities and teaching methods:
Link to Moodle will be given later. Lectures 30 h and exercises 20 h.

Target group:
Students of Electrical engineering. Other students of the University of Oulu may also participate.

Prerequisites and co-requisites:
Principles of electronic design

Recommended optional programme components:
This course is required when participating in Laboratory Exercises on Analogue Electronics.

Recommended or required reading:

Assessment methods and criteria:
Final or 2 mid-term exams.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5.

Person responsible:
Ilkka Nissinen
521070A: Introduction to Microfabrication Techniques, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Niina Halonen
Opintokohteen kielet: Finnish

Leikkaavuudet:
521218A Introduction to Microelectronics and Micromechanics 4.0 op
521218A-02 Introduction to Microelectronics and Micromechanics, demonstration 0.0 op
521218A-03 Introduction to Microelectronics and Micromechanics, exercise 0.0 op
521218A-01 Introduction to microelectronics and micromechanics, exam 0.0 op

ECTS Credits:
5

Language of instruction:
Finnish

Timing:
2nd period

Learning outcomes:
1. Can present the process of source materials used to manufacture micro- and nanoelectronics/micromechanics and analyse the required material properties depending of the application
2. Can explain the fabrication methods and discuss the characteristic features of each fabrication method, including their utilisation and restrictions.
3. Is capable of designing a fabrication process for a simple microelectronics application and is able to indentify the process steps also in complex application.

Contents:
The content of the course covers fabrication methods of micro-, nano- and optoelectronics as well as MEMS systems. 1. Fabrication methods for silicon based electronics and MEMS systems. 2. Additive manufacturing methods. 3. Nanomaterials and fabrication.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (20 hours) and exercises (10 +10).

Target group:
Electrical engineering bachelor degree students.

Prerequisites and co-requisites:
Course content of 521104P Introduction to Materials Physics and 521071A Principles of Semiconductor Devices.

Recommended optional programme components:
-

Recommended or required reading:
Assessment methods and criteria:
Final written exam and passes laboratory exercises.

Grading:
Numerical grading 1-5.

Person responsible:
Merja Teirikangas

Working life cooperation:
No

521404A: Digital Techniques 2, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Lahti
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
In Finnish. Exams can be arranged in English on demand.

Timing:
Autumn, period 2

Learning outcomes:
1. knows the common architectures of synchronous digital logic circuits, and the building blocks they consist of, and can design digital circuits that realize complex data and signal processing functions.
2. knows most common combinational and sequential logic based building blocks, and can use them to design and realize complex digital circuits.
3. knows digital logic design methods, such as use of hardware description languages, functional verification using simulation, realization of logic with a logic synthesis program, and functional and timing verification of gate-level models.

Contents:

Mode of delivery:
Classroom

Learning activities and teaching methods:
Lectures 24h/ exercises 30h (group work)/independent work 84h.

Target group:
Primarily electrical and computer science and engineering students. Also other student of University of Oulu can take the course.

Prerequisites and co-requisites:
Digital techniques 1

Recommended optional programme components:
No

Recommended or required reading:
Lecture textbook (in finnish) and literature announced during course.
Assessment methods and criteria:
Final exam and a design exercise, or weekly assignments consisting of theoretical and design exercises. Read more about assessment criteria at the University of Oulu webpage.

Grading:
1-5, The grade is the average of the exam and the design exercise.

Person responsible:
Jukka Lahti

Working life cooperation:
No

Other information:
-

521307A: Laboratory Exercises on Analogue Electronics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Kari Määttä
Opintokohteen kielet: Finnish
Leikkaavuudet:
  521316A  Broadband Communications Systems  4.0 op
  521433A  Laboratory Exercises on Analogue Electronics  3.0 op

ECTS Credits:
5

Language of instruction:
Finnish

Timing:
Autumn, periods 1-2

Learning outcomes:
1. is able to design basic electronic structural blocks and verify their functionality in a CAD simulation environment.

2. is able independently to realize and test a small-scale design object employing analogue circuit techniques.

Design exercises to deepen the understanding of the material presented in Principles of Electronics Design and Analogue Electronics I.

Contents:
Passive RC-circuits, diodes and their applications, bipolar transistor amplifiers, operational amplifiers and their applications, MOS-transistor, tuned circuit and amplifier, oscillator.

Mode of delivery:
Face-to-face teaching, partially independent work

Learning activities and teaching methods:
Independent design and simulating excercise 26 h and guided laboratory work 15 h. Group size is 1 - 2 students.

Target group:
Primarily in electrical engineering students. Other University of Oulu students can complete the course.
Prerequisites and co-requisites:
Student must participate to courses Principles of Electronics Design and Electronics Design I, or he/she must have passed these courses earlier.

Recommended optional programme components:
No

Recommended or required reading:
Lecture notes of Principles of Electronic design and Electronics design 1.

Assessment methods and criteria:
Teacher accepts student’s design work and measurement results in laboratory. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes verbal grading scale pass or fail

Person responsible:
Kari Määttä

Working life cooperation:
No

Other information:
- 521075S: Microelectronics Packaging Technologies, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Sami Myllymäki
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
Finnish

Timing:
3rd period

Learning outcomes:
1. Upon completing the course student can explain how electronics packaging technology has since invention of transistors to current date and can estimate how this development is going to continue in future.
2. The student can describe can explain what is meant by microjoining techniques and what are the pros and cons of these.
3. The student can tell what different kind of materials, and why, are used in IC packaging technology.
4. The student can explain what is meant with system level packaging and how the strong miniaturization on IC requires new system level packaging techniques to be developed.
5. He can explain why active and passive components are being, more and more, embedded to be a part of the circuit board.
6. In addition, he can explain why and how radio electronics will be migrate towards circuit board and components on it.

Contents:
Mode of delivery:
Face to face teaching

Learning activities and teaching methods:
Lecturing 24 h, practical work 12 h.

Target group:
Primarily major students of electrical engineering.

Prerequisites and co-requisites:
Recommended Introduction to Microfabrication Techniques.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course is completed with the final exam and finished course work.

Grading:
The course unit utilizes a numerical grading scale 1-5.

Person responsible:
Sami Myllymäki

Working life cooperation:
No

Other information:
-

521089S: Printed Electronics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Fabritius
Opintokohteen kielet: Finnish
Leikkaavuudet:
521217S Printed Electronics 4.0 op
521095S Advanced Course of Printed Electronics 3.0 op

ECTS Credits:
5

Language of instruction:
Finnish. English if more than two international students in the course.

Timing:
Period 3.

Learning outcomes:
1. Knows the most typical materials and printing methods suitable for their processing
2. Can explain the principles of materials and printing methods
3. Can utilize the material and manufacturing process knowledge to design fabrication processes for electrical components
4. Can analyse how the selected materials and printing methods influence on the performance of electrical components
Contents:
Materials (conductive and semi-conductive polymers, photoactive polymers, dielectrics, particle based inks) and processing methods (screen printing, gravure printing, flexo printing, inkjet) utilized in printed electronics, surface wetting and film formation, printed electrical components (passive components, solar cells, light emitting diodes, transistors) and their fabrication. Possibilities and challenges of printing based processing methods and how to take them into account in the printed electronics fabrication.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Combined lectures and exercises 30 h and self-study 100 h

Target group:
Primarily for the students of electrical engineering

Prerequisites and co-requisites:
None.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time

Recommended or required reading:
D.R. Gamota, P. Brazis, K. Kalyanasundaram and J. Zhang, "Printed organic and molecular electronics", handout

Assessment methods and criteria:
Course is completed by final examination.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Tapio Fabritius

Working life cooperation:
Not included.

521098S: Testing Techniques of Electronics and Printed Electronics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Fabritius
Opintokohteen kielet: Finnish

ECTS Credits:
5

Language of instruction:
Finnish. English, if there are more than 2 foreign students.

Timing:
Period 4.

Learning outcomes:
1. After completing the course the student is able to analyze different kinds of testing strategies, and is able to enhance the testability of electronics through the use of design for testability.
2. The student can also compare different testing techniques of analogue and digital electronics, which have been implemented using either embedded testing methods or external automatic testing equipment.
3. Additionally, the student is able to analyze tests made using an automatic test instrument, compare different test interfaces and data busses, and recognizes principles of design of a high-quality printed test circuit board.
4. The student understands the specific features of printed electronics having an influence on electronics testing and reliability.

Contents:
Overview of different testing methods, constructions of testers, test fixtures, test signal generation and measurement, mixed-signal test buses, DC- and parametric measurements, dynamic tests, AD/DA converter tests, DSP-based tests, data analysis, embedded testing, design for testability, Boundary scan, test applications.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 26h/Exercises 14h and self-studying 100 h.

Target group:
Course is compulsory for the Electrical engineering students in the advanced module of Testing techniques and printed electronics.

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course unit: Electronics Design I, Electronic Measurement Techniques.

Recommended optional programme components:
This course compensates 521098S Testing Techniques of Electronics if the student hasn’t got credits from it.

Recommended or required reading:
M. Burns, G. W. Roberts: An Introduction to Mixed-Signal IC Test and Measurement, Lecture slides. Additional material will be announced at the beginning of the course.

Assessment methods and criteria:
Exam and passed lab exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Grade is based on exam and grade is on numerical scale 1-5.

Person responsible:
Tapio Fabritius

Working life cooperation:
No.
Learning outcomes:
After the course the student can:
1. use Laplace transform for solving time and frequency response of electric circuits;
2. derive continuous-time transfer functions;
3. solve their poles and zeros and understand the meaning of those;
4. draw the pole-zero map and Bode plots of any given transfer function;
5. construct 2-port parameter models of a given circuit

Contents:
Use of Laplace transform in network analysis. Properties of network functions, poles and zeros, Boden magnitude and phase plots. 2-port parameter models.

Mode of delivery:
Classroom

Learning activities and teaching methods:
30h lectures, 22 h exercises, and simulation exercises.

Target group:
Finnish BSc students

Prerequisites and co-requisites:
Basics of circuit theory, differential equations.

Recommended optional programme components:
Continuation for Circuit theory 1. Needed in most analog electronics courses.

Recommended or required reading:

Assessment methods and criteria:
Final exam. Also the simulation exercise must be passed. Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical 1-5

Person responsible:
Prof. Timo Rahkonen

Working life cooperation:
-
Language of instruction:
Finnish

Timing:
Autumn, 1st period

Learning outcomes:
1. can define what radio engineering is and list its separate areas and applications from FM-radio to 5G systems.

2. understands the meaning of Maxwell's equations and can solve the propagation of radio waves in a homogeneous medium.

3. can solve EM-fields at an interface of two lossless media.

4. knows main properties of most common transmission line types and can solve EM-fields for coaxial lines and rectangular waveguides.

5. can utilize the methods based on the Smith chart for the impedance matching of microwave circuits and antennas.

6. understands the meaning of Y-, Z-, and S-matrix and can use S-parameters for solving characteristics of microwave circuits.

7. can describe the operation of passive transmission line devices, resonators, filters and circuits based on the semiconductor devices.

8. knows the terms to describe antenna characteristics and can define radiation patterns of simple antennas and antenna arrays.

9. knows different propagation phenomena and can evaluate, which phenomena are relevant in different radio systems in different frequency bands.

10. can describe the structure of a typical radio system and can calculate the S/N-ratio link budget for a radio system on a free-space radio link.

Contents:

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 26 h and exercises 16 h including graded exercise problems.

Target group:
3rd year bachelor's degree students.

Prerequisites and co-requisites:
Elementary knowledge of the electromagnetic theory.

Recommended optional programme components:
-

Recommended or required reading:
In Finnish: Antti Räisänen & Arto Lehto: Radiotekniikan perusteet. Otatieto, 2011; also older versions of the book can be used as a course book.
Assessment methods and criteria:
The course is passed with a final examination. Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5.

Person responsible:
Risto Vuohtoniemi, Aarno Pärssinen.

Working life cooperation:
No

Other information:
-

521304A: Filters, 5 op

Voimassaolo: 01.08.2015 -
Opiskelmuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Rahkonen, Timo Erkki
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5

Language of instruction:
Finnish. Exams can be arranged in English on demand.

Timing:
Spring, period 3

Learning outcomes:
After the course the student can:
1. draw a pole-zero map for a given transfer function;
2. perform impedance and frequency scaling for component values;
3. choose an appropriate prototype filter and filter degree;
4. synthesize passive RLC filters;
5. synthesize active opamp based filters;
6. can compare various filter technologies;
7. understands the basics of scaling the dynamic range of active filters

Contents:
Filter types and prototypes, component scaling. Synthesis of active and passive filters. Sensitivity analysis and scaling of the dynamic range.

Mode of delivery:
Lectures, excercise and design excercise

Learning activities and teaching methods:
30 h lectures, 16 h exercises. A design excercise.

Target group:
Finnish electrical engineering students

Prerequisites and co-requisites:
Basics of circuit theory, Bode plots and analog design.
**Recommended optional programme components:**
Course Digital filters expands the topic into digital domain.

**Recommended or required reading:**

**Assessment methods and criteria:**
Circuit is examined by a final exam. Also the obligatory design exercise must be passed. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
1-5

**Person responsible:**
Prof. Timo Rahkonen

**Working life cooperation:**
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**Other information:**
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**521395S: Wireless Communications I, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Electrical Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Timo Kokkonen, Jari Iinatti

**Opintokohteen kielet:** English

**Leikkaavuudet:**
- 521395S-01 Wireless Communications I, Exam 0.0 op
- 521395S-02 Wireless Communications I, Exercise 0.0 op
- 521323S Wireless Communications 2 5.0 op
- 521323S-02 Wireless Communications I, Exercise 0.0 op
- 521320S Wireless Communications 2 8.0 op
- 521320S-01 Intermediate exam or final exam, Wireless Communications 1 0.0 op
- 521320S-02 Exercisework, Wireless Communications 2 0.0 op
- 521323S-01 Wireless Communications I, Exam 0.0 op

**ECTS Credits:**
5

**Language of instruction:**
English

**Timing:**
Fall, period 1

**Learning outcomes:**
Student
1. can analyze the performance of multilevel digital modulation methods in AWGN channel
2. can explain the effect of fading channel on the performance of the modulation method and can analyze the performance
3. recognizes and understand suitable diversity methods for fading channel and related combining methods
4. can understand and explain coding methods for wireless channels
5. recognizes different wideband systems
6. understands the cellular system principle

**Contents:**
Radio channel models, digital modulation and detection methods, carrier and symbol synchronization, performance of digital modulation in AWGN and fading channel, diversity techniques, coding for wireless channel, multicarrier modulation, spread spectrum, cellular systems.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures and exercise (total 40 hours) and the compulsory design work with a simulation program.

**Target group:**
1st year WCE students and M.Sc. students (i.e., 4th year in ECE degree programme)

**Prerequisites and co-requisites:**
521330A Telecommunication Engineering

**Recommended optional programme components:**

**Recommended or required reading:**

**Assessment methods and criteria:**
The course is passed with minor exams (only during lecture period) or with final exam; and the accepted design work report. In the final grade of the course, the weight for the examination(s) is 0.6 and that for the design work report 0.4.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Jari Iinatti / Timo Kokkonen

**Working life cooperation:**
Visiting lecturers from industry.

**Other information:**

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**521340S: Communications Networks I, 5 op**

**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Electrical Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Mika Ylianttila
**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS cr

**Language of instruction:**
English

**Timing:**
Fall, period 2

**Learning outcomes:**

1. Students understand how the modern communications networks have evolved and how the architecture has changed through the recent paradigm shift towards software-centric communications.
2. Students are able to describe the basic system architecture elements of mobile networks, and understands the significance of emerging technologies such as Network Function Virtualization (NFV), Software Defined Networking (SDN), and core network functionalities such as Evolved Packet Core (EPC).
3. Students can describe the main principles of mobility management, network management and orchestration, and network security, and can apply and solve related engineering problems.
4. Students know the basic properties of routing algorithms, and can use graph theory to solve network routing problems.
5. Students are able to simulate different types of networks in simulation environments and solve basic network programming problems. Upon completing the required coursework, students understand the basic functionalities in TCP/IP protocol stack.

Contents:
Communications architecture in mobile, wireless local area and personal area networks. Introduction to cloud and edge computing, network function virtualization and software defined networking. Basic principles of mobility management, network security, network management and orchestration. The goal is to present the basics of the modern communications architectures, and their technical implementation.

Mode of delivery:
Due to Covid-19 pandemic, teaching in Autumn 2020 will be implemented remotely. Details of arrangement can be found from the course web page, which will be available in Moodle.
https://moodle.oulu.fi/course/view.php?id=1454

Learning activities and teaching methods:
Lectures 30 h and the compulsory design work (15 h). Design work can be done alternatively either as NS-2 simulation or TCP/IP programming exercise. Design work instructions are provided in digital learning environment (Moodle).

Target group:
1st year M.Sc. and WCE students

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Software Defined Mobile Networks (SDMN): Beyond LTE Network Architecture, M Liyanage, A Gurtov, M Ylianttila – 2015; A comprehensive Guide to 5G Security, M Liyanage, I Ahmad, A Abro, A Gurtov, M Ylianttila – 2018; In addition, selected supportive online reading materials from recent standards and publications are provided in digital learning environment (Optima / Moodle).

Assessment methods and criteria:
The course is passed with a final examination and the accepted design work report. The final grade is based on examination. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5.

Person responsible:
Mika Ylianttila

Working life cooperation:
No

Other information:
-

521349S: Wireless Communications II, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Antti-Heikki Tölli
Opintokohteen kielet: English
ECTS Credits: 5

Language of instruction: English

Timing: Spring, period 3

Learning outcomes:
1. The student is familiarised with the channel capacity as the fundamental performance measure of wireless communication links, and can explain the effect of fading channel on the capacity in a single-user single-antenna scenarios.
2. The student understands the basic principles for multiuser communications in fading channels, apprehends the notion of capacity region for multi-access and broadcast channels, and is familiarised with different practical multiple access, random access and scheduling methods.
3. The student is acquainted with core principles of adaptive transmission, which requires accurate channel estimates at the receiver and a reliable information exchange mechanisms between the receiver and transmitter. Practical variable-rate variable-power MQAM modulation techniques for fading channels are introduced.
4. The student understands the principles of transmitter and receiver design in the presence of channel distortion. The student is familiarised with various (adaptive) equalization solutions to combat intersymbol interference.
5. Finally, the student is acquainted with the capacity optimal multi-antenna transmission and reception scheme, as well as, with basic multiantenna space-time coding schemes in a single-user multiple-input multiple-output (MIMO) communications scenario.

Contents:
Capacity of wireless channels, multiuser communications, adaptive modulation and coding, equalization, point-to-point MIMO communications and space-time coding.

Mode of delivery:

Learning activities and teaching methods:
Lectures and exercise (total 40 hours) and the compulsory design work with a simulation program (20 h).

Target group:
1st year WCE students and M.Sc. students (i.e., 4th year in ECE degree programme).

Prerequisites and co-requisites:
In addition to courses “521395S Wireless Communications I”, 521348S “Statistical Signal Processing I”, 031025A “Introduction to optimization” and 031051S “Numerical matrix analysis”, a working knowledge in digital communications, random processes, linear algebra, matrix manipulation and detection theory is required.

Recommended optional programme components:
Prior knowledge of 521390S Information Theory and 521392S Convex Optimisation is very useful but not mandatory. The course 521324S Statistical Signal Processing II is recommended to be taken in parallel.

Recommended or required reading:

Assessment methods and criteria:
The course is passed with a final examination and the accepted simulation work report. The final grade is a weighted sum of exam (70%), homework (20%), and work report (10%).

Grading:
The course unit utilizes a numerical grading scale 1-5.
Person responsible: Antti Tölli
Working life cooperation: No
Other information: Course replaces the old course 521317S Wireless Communications II (8cr).

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible: University lecturer Osmo Kauppila

A440265: Complementary Module, Medical and Wellness Technology, 20 - 30 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Electives

764327A: Virtual measurement environments, 5 op
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Jämsä, Timo Jaakko
Opintokohteen kielet: Finnish
Leikkaavuudet:

764627S Virtual measurement environments 5.0 op

Proficiency level:
- Status:
- Required proficiency level:
-
ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
Finnish (or English)

Timing:
Bachelor studies, autumn term, 2nd period

Learning outcomes:
The student will learn how to construct software environments for measurements and data analysis important in biomedical engineering and physics

Contents:
The course gives basic skills to use measuring and analyzing programmes applied not only in academic research but also in R&D of the companies, and their programming environments (Matlab, LabView).

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 12 h, project work 65 h, self-study 58 h

Target group:
Bachelor students of Medical and Wellness Technology and Physics. Also for other students of the University of Oulu.

Prerequisites and co-requisites:
Basics / basic skills in programming

Recommended optional programme components:
The course is independent entity and does not require additional studies carried out at the same time. The course can also be completed as a part of advanced studies with the course code 764327S.

Recommended or required reading:
Lecture and exercise notes, other given material

Assessment methods and criteria:
Completion of projects. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5 or fail. In the numerical grading scale zero stands for a fail. Grading is made based on the projects.

Person responsible:
Professor Timo Jämsä

Working life cooperation:

Other information:

521273S: Biosignal Processing I, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Seppänen, Zalan Rajna
Opintokohteen kielet: Finnish
ECTS Credits:
5 ECTS credits.

Language of instruction:
English.

Timing:
The course unit is held in the autumn semester, during period 2. It is recommended to complete the course at the master's degree level.

Learning outcomes:
After completing the course, student:
1. knows about special characteristics of the biosignals and typical signal processing methods
2. can solve small-scale problems related to biosignal analysis
3. implement small-scale MATLAB software for signal processing algorithms.

Contents:

Mode of delivery:
Face-to-face teaching and guided laboratory work. The laboratory work can alternatively be performed on an online system (MathWorks Grader). Student can do the lab works remotely or in the lab using the same online system.

Learning activities and teaching methods:
Lectures 12h, Laboratory work 24h, Self-study for laboratory working and examination 99 h.

Target group:
Students interested in digital signal processing applications in biomedical engineering, at their master's level studies.

Prerequisites and co-requisites:
The mathematic studies of the candidate degree program of computer science and engineering, or equivalent. Programming skills, especially basics of the MATLAB. Basic knowledge of digital signal processing.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
The course is based on selected chapters of the book "Biomedical Signal Analysis", R.M Rangayyan, 2nd edition (2015). + Lecture slides + Task assignment specific material.

Assessment methods and criteria:
Face-to-face lectures. Students solve the programming problems in the laboratory work independently, supervised by assistants. The MathWorks Grader online system is used for programming tasks and it also verifies the completed tasks. Written examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Tapio Seppänen

Working life cooperation:
No.

080929S: Health Technology and Multimodal Monitoring, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuksikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opertajat: Teemu Myllylä
Opintokohteen kielet: English

Proficiency level:
-

Status:
-

Required proficiency level:
-

ECTS Credits:
5 ECTS credit points /135 hours of work

Language of instruction:
English

Timing:
The course is held in the Spring semester, during period III.

Learning outcomes:
The course provides students with a broad overview of the health technology that is currently in development and becoming for home and/or clinical use. Students learn the concepts of multimodal monitoring and examples of its usage in clinical applications and in medical research (including human and animal studies).

Contents:
Multimodal monitoring is increasingly being employed in clinical monitoring and in the study of human physiology. It is the simultaneous measurement of multiple physiological parameters to provide better context for their interpretation and correlations, and to enable studies of relationships between different physiological signals. Besides the concepts of multimodal monitoring, this course provides students a broad overview of the health technology that is currently in development and becoming for home or clinical use. Moreover, their usage in medical applications and for different study purposes (human and animal) are dealt.

Mode of delivery:
Web-based teaching + Face-to-face teaching

Learning activities and teaching methods:
Lectures, demonstrations, seminars and self-study

Target group:
Medical and biomedical engineering students

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Reading material will be provided during the course.

Assessment methods and criteria:
The assessment of the course is based on the learning outcomes of the course, based on the seminar work and exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Adjunct professor Teemu Myllylä

Working life cooperation:
There is no working life cooperation in this course
521097S: Wireless Measurements, 5 op

Voimassaolo: 01.08.2015 -  
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Christian Schuss
Opintokohteen kielet: English

Leikkaavuudet:

- 521114S Wireless Measurements 4.0 op
- 521114S-01 Wireless Measurements, exam 0.0 op
- 521114S-02 Wireless Measurements, exercise work 0.0 op

ECTS Credits:

- 5 ECTS credits / 128h

Language of instruction:

In English

Timing:

Period 3.

Learning outcomes:

1. can tell and justify argument the benefits and challenges of using wireless measurement solutions 
2. can apply the most important standards when designing wireless measurement solutions 
3. can apply wireless technologies in industrial, traffic, environmental, home and healthcare measurements

Contents:

Basics of wireless measurement technologies and standards, wireless sensors and sensor networks, wireless building and smart home applications, wireless measurement applications in traffic, wireless environmental measurements and wireless human health monitoring.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 22h. Seminars 6-12h depending on the number of students participating the course. The students prepare seminar presentations about contemporary topics selected by themselves or proposed by the teacher and give 10 minutes presentation to other students in the seminars.

Target group:

Master level students regardless of master’s programme.

Prerequisites and co-requisites:

No prerequisites, but basics of measurements systems are recomended.

Recommended optional programme components:

The course replaces previous courses with same name, but different credits and code.

Recommended or required reading:

Lecture notes and seminar reports is Optima.

Assessment methods and criteria:

The course is passed with a written final exam (70 %) and a contemporary seminar (30 %). Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grade is on numerical scale 1-5.
Person responsible:
Christian Schuss

Working life cooperation:
No.

080916S: Biomechanics of Human Movement, 5 op

Voimassaolo: 01.08.2012
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Jämsä, Timo Jaakko
Opintokohteen kielet: English

Proficiency level:
-

Status:
-

Required proficiency level:
-

ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English

Timing:
Master’s studies, spring term 4th period

Learning outcomes:
The student can describe the main challenges of movement biomechanics and principles for motion analysis.
The student understands basics of biomechanical measurement and modeling of movement.
The student can perform practical biomechanical experiments, analyze measurement data, interpret results, and report them using good scientific reporting practice.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 14h / Assignment and group work 54h / Self-study 67h. Final exam

Target group:
Master’s students of biomedical engineering, medical and wellness technology, information technology and other related degree programs. Master’s students of physics (biomedical physics). Other interested master's and postgraduate students.

Prerequisites and co-requisites:
The student needs to have basic knowledge on statistical analysis, sensors and measurement techniques and signal processing. It is also recommended to have basic knowledge of anatomy and physiology.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. Tissue biomechanics will be studied in the course 080915S.

Recommended or required reading:
Material given during lectures

Assessment methods and criteria:
Accepted home exercises and lab assignments, exam. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Grading is made based on the exercise report and exam.

Person responsible:
Professor Timo Jämsä

Working life cooperation:
None

Other information:

521093S: Biomedical Instrumentation, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysiköt: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Teemu Myllylä
Opintokohteen kielet: Finnish
Leikkaavuudet:

521107S Biomedical Instrumentation  6.0 op

ECTS Credits:
5

Language of instruction:
English.

Timing:
Period 4.

Learning outcomes:
After the course the student is capable to explain principles, applications and design of medical instruments most commonly used in hospitals. He/she can describe the electrical safety aspects of medical instruments and can present the physiological signals commonly measured on humans. In addition the student is able to explain medical instrumentation development process and the factors affecting it. He/she also recognizes typical measurands and measuring spans and is able to plan and design a biosignal amplifier.

Contents:
Diagnostic instruments (common theories for medical devices, measurement quantities, sensors, amplifiers and registering instruments). Introduction to medical imaging and monitoring methods and instruments and physical therapy devices. Electrical safety aspects.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures/exercises 30 h and self-study 100 h.

**Target group:**
Students interested in biomedical measurements.

**Prerequisites and co-requisites:**
None

**Recommended optional programme components:**
Course replaces earlier courses Biomedical measurements and Biomedical instrumentation.

**Recommended or required reading:**

**Assessment methods and criteria:**
The course is passed by the final exam or optionally with the assignments/test agreed at the first lecture. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
1 - 5.

**Person responsible:**
Teemu Myllylä

**Working life cooperation:**
No.

**080927S: Connected Health and mHealth, 5 op**

**Voimassaolo:** 01.08.2017 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Health Sciences
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Jarmo Reponen
**Opintokohteen kielet:** English

**Proficiency level:**
-

**Status:**
-

**Required proficiency level:**
-

**ECTS Credits:**
5 ECTS, 135 hours of work

**Language of instruction:**
English

**Timing:**
The course is held in the autumn semester period I (1st period)

**Learning outcomes:**

Upon completion of the course:
- The students will have knowledge about the current overall status of clinical use of health information systems and related tools (e.g. e-Health, telemedicine, Virtual Hospital, ODA-portal and other self-care portals) in Finland
- The students will have knowledge about the state of the art development in mobile health technology solutions and connected health projects.
- The students have been introduced to some practical development examples taking place in OYS Testlab and possibly in other Oulu health test labs.
- The students have had an opportunity to consult with some enterprises currently working in the m-Health / Connected health domain.
- Depending on the student composition of the course, the students have learned collaboration and co-creation in a multiprofessional environment in the medical information and communication technology domain.

Contents:

- Terms and concepts
- Overview of information and communication technology and information systems in Finnish healthcare
- New processes that activate patient: virtual hospital, self-care models
- Current update about mHealth, Connected Health, Artificial Intelligence in health care, secondary use of healthcare information
- Collaborative development process in multiprofessional healthcare environment
- Introduction to test laboratories
- Case example, depending of current R&D&I work at the time of course
- Web discussions and possible group assignments

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

The implementation methods of the course vary. The course will consist of a combination of self-learning materials and activating workshops and other modules. The below mentioned numbers of hours are approximations, because the actual contents will vary according to available development projects:

- Virtual learning material in the university virtual learning environment (recorded lectures, examples, additional material) /with self-learning 40 hours of student’s time
- Activating facilitated workshops, where the iterative innovation process is introduced to the students + introductions to the test laboratory environment + special key-note lectures either in the virtual environment or as participatory lectures in seminars /with self-learning 40 hours of student’s time
- Discussions and participation to web tasks /with self-learning 40 h of student’s time
- Exams and related work /with self-learning 15 h hours of student’s time

Target group:

Students of the Master’s Programs in Biomedical Engineering and Medical & Wellness Technology. The course will also be available as an elective course for medicine, health sciences, information technology and other interested degree programs.

Prerequisites and co-requisites:

- Recommended optional programme components:
  It is recommended that the student has completed the course 041201A Basics in eHealth.

Recommended or required reading:

Recommended or required reading is offered in Oulu University’s virtual learning environment and in linked web pages. The teachers can recommend additional material in the beginning of the course

Assessment methods and criteria:

Web tasks, contribution to moderated discussion and workshops, and course exams. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1 – 5 or fail.

Person responsible:

Professor Jarmo Reponen (responsible teacher)
Professor Minna Pikkarainen
Course assistant teacher Anna Maijala MSc

Working life cooperation:

The facilitated workshops are meant to be organized in collaboration with OuluHealth TestLabs and enterprises according to availability.

Other information:
555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suoritaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

A440266: Complementary Module, Software Engineering, 20 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Common studies

811372A: Software Development, Maintenance and Operations, 5 op

Voi massaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Mika Mäntylä
Opintokohteen kielet: English
Leikkaavuudet:
  ay811372A  Software Development, Maintenance and Operations (OPEN UNI)  5.0 op
  815312A  Software Production and Maintenance  5.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
English

Timing:
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st autumn semester of the Master's studies.

Learning outcomes:
After completing the course, the student will able to:
* explain and utilize theories of software evolution,
* utilize the processes, techniques and tools for software deployment, and operations,
* utilize the processes, techniques and tools for software maintenance, as well as
* utilize the processes, techniques and tools to better understand and maintain large code bases.

**Contents:**
* Software Maintenance and Evolution
* Software Product Lines
* Software Maintenance and Evolution Models
* DevOps
* Reengineering
* Legacy Systems

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures (Video): 20 h, exercises / assignments 78 h, weekly study 42 h

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and programming.

**Recommended or required reading:**
Videos, books, exercises

**Assessment methods and criteria:**
Exercises, assignements

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Mika Mäntylä

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**Software Production**

**811373A: Professional Software Engineering Processes and Human Factors, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Information Processing Science DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Minna Isomursu
**Opintokohteen kielet:** English

**Leikkaavuudet:**
- ay811373A Professional Software Engineering Processes and Human Factors (OPEN UNI 5.0 op
- 815662S Software Engineering Management, Measurement and Improvement 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English

**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 1st autumn semester of the Master's studies.

**Learning outcomes:**
After completing the student will be able to:
* recognize and describe software development processes models,
* evaluate and compare their applicability in different contexts,
* take human factors into account in planning and operating in professional software development,
* analyze their own strengths and improvement areas as software engineers to see opportunities for development, as well as
* participate in systematic efforts for improvement in software development organizations.

Contents:
Module 1: Software development process models. Theory and cases.
Module 2: Human factors in software development. Recognizing individual and team characteristics, and cultivating personal awareness and development pathways.
Module 3: Software process improvement. Theory and cases.

Mode of delivery:
Introduction lecture (not mandatory), online assignments, 2-3 lectures of visiting professionals (not mandatory), seminar (online option)

Learning activities and teaching methods:
Individual and group activities.
All materials, assignments and group work will be done online.

Target group:
MSc students

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Development, Maintenance and Operations.

Recommended or required reading:
Provided in Moodle.

Assessment methods and criteria:
Completing online assignments, active participation in peer feedback

Grading:
Pass or fail

Person responsible:
Minna Isomursu

Working life cooperation:
Visiting lectures of experienced software professionals (2-3)
Learning outcomes:
After completing the course, the student can assess the role of human interaction with IT products, systems, and services and identify factors and problems related to it within a practical design case. The student is able to: use methods for analysis and evaluation of existing interfaces; understand the role of requirements, plan and conduct a simple requirements collection and analysis; use basic principles of usability and user experience for user interface design; use interaction design methods in designing for target user experiences.

Contents:
The course provides an overview of interaction design, introducing the terminology and fundamental concepts, the main activities, and the importance of user involvement in the design process. The course addresses establishing requirements for IT products, systems, and services. The focus is on usability and user experience from the viewpoint of the intended users, their tasks and the context of use. The course covers user-centered methods for designing for and evaluating usability and user experience of IT products, systems, and services. All the main activities of interaction design are carried out in a practical design case.

Mode of delivery:
Self study

Learning activities and teaching methods:
Self-study: assignments and/or an exam

Target group:
MSc students

Prerequisites and co-requisites:
Basic knowledge on human-computer interaction with usability and user-centered design.

Recommended or required reading:

Assessment methods and criteria:
Accepted assignments.

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Netta Iivari
Upon completion of the course, the student will be able to:
1. have basic understanding on how to collaboratively design a small-scale software project,
2. have basic understanding on how to implement and evaluate a small-scale software project,
3. be able to extensively document a small-scale software project,
4. be able to present and "pitch" a project work, i.e. give a good, concise presentation of the work

Contents:
The basics concepts and practices of implementing a software project in the domain of applied computing

Mode of delivery:
Online teaching, project work in groups

Learning activities and teaching methods:
8 hours of introductory lectures. Majority of the course is guided project work

Target group:
3rd year Computer Science and Engineering B.Sc. students and other Students of the University of Oulu.

Prerequisites and co-requisites:
Elementary Programing (521141P), Human-Computer Interaction (521145A) or corresponding skills

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course uses continuous assessment so that the project work is assessed in stages: design (20% of total grade), implementation (40%), evaluation (20%), and final report (20%). Passing criteria: all stages (design, implementation, evaluation, report) must be completed with an approved grade. Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5; zero stands for a fail.

Person responsible:
Timo Ojala

Working life cooperation:
The projects that the students will undertake are defined either by the research group or industry partners.
In the projects defined by the industry, the students will carry out a development project to create a solution for the company’s genuine and existing challenges. The project reports regularly to the project steering group consisting of a supervising teaching assistant as well as the company representative. In addition, the course can have guest lectures from industry regarding collaborative software development and evaluation practices.

Other information:
The 521275A course offers the possibility to complete your Bachelor thesis in a structured course environment. The course is suitable also for students who do not use the course for their Bachelor Thesis. Using Google Glassroom.

The course is in Moodle: https://moodle.oulu.fi/course/view.php?id=5086
**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English

**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd autumn semester of the Master's studies.

**Learning outcomes:**
After completing the course, the student will be able to:
* understand and utilize software quality models,
* understand and utilize some software testing and security techniques, and understand their benefits and limitations, as well as
* apply software testing and security techniques in small scale projects.

**Contents:**
* Testing and quality techniques: Model-based testing, search-based testing, defect prediction, exploratory testing, combinatorial testing, static testing, static analyzers, virtualization, test automation,
* Security Attacks buffer overflows, command injection; Security testing: vulnerability scanning, intrusion detection.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lecture 16 h, Exercises 24 h

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Professional Software Engineering Processes and Human Factors.

**Recommended or required reading:**
Lectures, Slides, Articles

**Assessment methods and criteria:**
Assignments, Exercises, Essays

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Alireza Haghighatkhah

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**811603S: Software Platforms and Ecosystems, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Information Processing Science DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Juustila, Antti Juhani
**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English

**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Master's studies.

**Learning outcomes:**
After completing the course, the student will be able to:
* define what are software platforms and ecosystems,
* understand how software platforms and ecosystems can be used for business,
* analyze the benefits and drawbacks of different platforms or ecosystems, as well as
* operate, use and make contributions to a particular software platform or ecosystem.

**Contents:**
* Introduction to software platforms and ecosystems
* Business and strategic aspects of platforms and ecosystems
* Development of software systems utilizing platforms or ecosystems
* Benefits and drawbacks of platforms or ecosystems - business and development views
* Case studies, practical project with a selected platform or ecosystem

**Mode of delivery:**
Lectures, exercises, group work, demonstrations, project work.

**Learning activities and teaching methods:**
Lectures 24 h, exercises or group work 24 h, independent study 52 h, assignments 48 h

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Advances Software Quality and Security

**Recommended or required reading:**
Announced in the beginning of the course

**Assessment methods and criteria:**
Exam, graded project work and reports, graded assignments.

**Grading:**
Numerical scale 1-5 or fail.

**Person responsible:**
Antti Juustila

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521156S: Towards Data Mining, 5 op

**Voimassaalo:** 01.08.2017 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuyksikkö:** Computer Science and Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Satu Tamminen
**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits

**Language of instruction:**
English

**Timing:**
Autumn, period I.

**Learning outcomes:**
After completing this course, student can recognize data types and perform required pre-processing steps before further analysis:
1. Student can design and implement a data collection process
2. Student can combine data from different sources
3. Student can normalize and transform data, and handle missing or incorrect values
4. Student can ensure generalizability of the results

Contents:
Course provides good ability to start Master's Thesis or graduate studies. Topics at the course include data mining process in general level, data gathering and different data types, quality and reliability of the data, data preparation including the processing of missing values, outliers, and privacy issues, combination of signals from several sources, utilization of data bases in data mining process, and normalization and transformation of data and interdependence of the observations and their distributions. Additionally, topics concerning the generality of the results are covered, as well as, the principles of data division, for example, train-test-validate, cross-validation and leave-one-out methods.

Mode of delivery:
Lectures, independent work, group work

Learning activities and teaching methods:
16 h lectures, 16 h exercises, independent studying.

Target group:
The course is suitable for Master level students in Computer science and engineering study programmes, for minor subject studies or for doctoral students.

Prerequisites and co-requisites:
031021P Probability and Mathematical Statistics or similar

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture hand-out and exercise material will be provided. The course book will be announced in the beginning of the course. The material is mostly in English.

Assessment methods and criteria:
Weekly pre-lecture assignment + exercise submissions, and final exam. Half of the grade will be based on the submissions and half on the final exam.

Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5; zero stands for a fail.

Person responsible:
Tamminen Satu

Working life cooperation:
-

Other information:
Moodle: https://moodle.oulu.fi/course/view.php?id=1679
Towards Data Mining 521156S:3

811604S: Software for Intelligent Systems and Artificial Intelligence (AI), 5 op

Voimassaolo: 01.08.2019 - 
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Minna Isomursu
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Timing:
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 2nd spring semester of the Master's studies.

Learning outcomes:
After completing the course, the students will be able to:
* reflect and critically assess the role of AI in software intensive services,
* reflect and discuss issues related to design of software intensive services using AI, as well as
* develop a project using the methods and theory learned throughout the course.

Contents:
The course consists of four main modules. These are:
* Introduction to the course
* Basics of AI in software intensive services
* AI project, the theme will be decided yearly
* theoretical reflective learnings

Mode of delivery:
Introduction lecture, online assignments, final seminar

Learning activities and teaching methods:
Individual online assignments, project work executed in groups, peer feedback in seminar

Target group:
MSc students

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Platforms and Ecosystems

Recommended or required reading:
Provided in Moodle

Assessment methods and criteria:
Online assignments, project work with presentation

Grading:
Pass or fail

Person responsible:
Minna Isomursu

813623S: Information Security Policy and Management in Organisations, 5 op

Voimassaolo: 01.08.1950 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Nataliya Shevchuk
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work.

Language of instruction:
English

Timing:
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 2nd spring semester of the Master’s studies.
Learning outcomes:
After completing the course, the student will be able to:
* develop BCM (Business Continuity Management) and SA (Systems Availability) strategy;
* develop organization specific information security policies in organizations;
* conduct Information Security (and risk) Analysis;
* conduct Information Security Audits;
* understand information security standards, regulations, and policies;
* improve employees’ compliance with the information security procedures through training, campaigning and other means;
* describe certifications related to information security (such as ISO27001); as well as
* describe public-key infrastructure (PKI), Digital signature, & Certification authority (CA).

Contents:
* Business Continuity Management (BCM) and Systems Availability (SA)
* Information Security Life Cycle
* Conduct Information Security (and risk) Analysis;
* Information security standards, regulations, and policies
* Information security investment management
* Insider threats in information security management
* Security Audits (Active Security Assessment)
* Information Security Certification (ISO27001) & Certification authority (CA)

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures (24 h), exercises (23 h), learning diary (30 h), essay (20 h), examination (36 h)

Target group:
MSc students

Prerequisites and co-requisites:
Understanding of information security issues, principles, techniques, or similar knowledge, is helpful.

Recommended or required reading:
Research articles to be announced more specifically during the course implementation.

Assessment methods and criteria:
Examination.

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Nataliya Shevchuk

521453A: Operating Systems, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Röning
Opintokohteen kielet: English
Leikkaavuudet:
    ay521453A Operating Systems (OPEN UNI) 5.0 op

ECTS Credits:
5

Language of instruction:
In Finnish, material available in English
**Timing:**
Spring, period 4

**Learning outcomes:**
1. is capable of explaining the basic structure and functioning of operating system
2. is able to point the problems related to process management and synchronization as well as is able to apply learned methods to solve basic problems
3. is capable of explaining the cause and effect related to deadlocks and is able to analyse them related to common circumstances in operating systems
4. is able to explain the basics of memory management, the use of virtual memory in modern operating systems as well as the structure of the most common file-systems.

**Contents:**
Operating system structure and services, process management, process synchronization, deadlocks, memory management, virtual memory, file-systems

**Mode of delivery:**
Face-to-face.

**Learning activities and teaching methods:**
Lectures 36 h, laboratory exercise 4 h, the rest as independent work. The laboratory work, including pre-exercise and guided exercise performed in a group of one or two students in the unix environment, covers core topics of the course.

**Target group:**
Computer Science and Engineering students and other Students of the University of Oulu.

**Prerequisites and co-requisites:**
521141P Elementary Programming, 521286A Computer Systems or 521142A Embedded Systems Programming and 521267A Computer Engineering

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

**Assessment methods and criteria:**
The course is passed the final examination and accepted laboratory working. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Juha Röning (lectures)
Anna-Mari Wartiainen (exercises)

**Working life cooperation:**
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**Other information:**
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811312A: Data Structures and Algorithms, 5 op

**Voimassaolo:** 01.08.2010 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Information Processing Science DP
**Arvostelu:** 1 - 5, pass, fail
Opettajat: Juustila, Antti Juhani
Opintokohteen kielet: Finnish
Leikkaavuudet:
  521144A   Algorithms and Data Structures   6.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work.

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Bachelor's studies.

Learning outcomes:
After completing the course the student will be able to:
* select data structures and algorithms to an application,
* apply induction when proving algorithm correctness and define recursive algorithms,
* describe trees, graphs and their basic algorithms and apply them in a program,
* describe the most common sorting algorithms, as well as
* analyse the correctness and time complexity of an algorithm implemented in a program.

Contents:
* Basic data structures
* Analysis of algorithms
* Sorting algorithms
* Hash tables
* Binary search trees
* Graphs and their algorithms
* Algorithm design paradigms

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 48 h, exercises 21 h, exercise work 27 h, independent study 39 h.

Target group:
BSc students.

Prerequisites and co-requisites:
The required prerequisite is that the learning outcomes of the following courses are accomplished: Databases

Recommended optional programme components:

Recommended or required reading:
Cormen, Leiserson, Rivest, Stein: Introduction to algorithms, Second edition, MIT Press 2001 (or newer) and other material defined during the course.

Assessment methods and criteria:
1. Exam and assignment OR 2. Mid-term exams (2) and assignment

Grading:
Numerical scale 1-5 or fail.

Person responsible:
Antti Juustila
555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

A440267: Complementary Module, Information Engineering, 20 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokevauksia.

Artificial Intelligence

521156S: Towards Data Mining, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Satu Tamminen
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits
Language of instruction:
English
Timing:
Autumn, period I.
Learning outcomes:
After completing this course, student can recognize data types and perform required pre-processing steps before further analysis:
1. Student can design and implement a data collection process
2. Student can combine data from different sources
3. Student can normalize and transform data, and handle missing or incorrect values
4. Student can ensure generalizability of the results

Contents:
Course provides good ability to start Master’s Thesis or graduate studies. Topics at the course include data mining process in general level, data gathering and different data types, quality and reliability of the data, data preparation including the processing of missing values, outliers, and privacy issues, combination of
signals from several sources, utilization of data bases in data mining process, and normalization and transformation of data and interdependence of the observations and their distributions. Additionally, topics concerning the generality of the results are covered, as well as, the principles of data division, for example, train-test-validate, cross-validation and leave-one-out methods.

**Mode of delivery:**
Lectures, independent work, group work

**Learning activities and teaching methods:**
16 h lectures, 16 h exercises, independent studying.

**Target group:**
The course is suitable for Master level students in Computer science and engineering study programmes, for minor subject studies or for doctoral students.

**Prerequisites and co-requisites:**
031021P Probability and Mathematical Statistics or similar

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Lecture hand-out and exercise material will be provided. The course book will be announced in the beginning of the course. The material is mostly in English.

**Assessment methods and criteria:**
Weekly pre-lecture assignment + exercise submissions, and final exam. Half of the grade will be based on the submissions and half on the final exam. Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
Numerical grading scale 1-5; zero stands for a fail.

**Person responsible:**
Tamminen Satu

**Working life cooperation:**
-

**Other information:**
Moodle: https://moodle.oulu.fi/course/view.php?id=1679
Towards Data Mining 521156S:3

521289S: Machine Learning, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Computer Science and Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Tapio Seppänen
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**
- 521497S-01 Pattern Recognition and Neural Networks, Exam 0.0 op
- 521497S-02 Pattern Recognition and Neural Networks; Exercise Work 0.0 op
- 521497S Pattern Recognition and Neural Networks 5.0 op

**ECTS Credits:**
5 ECTS credits.

**Language of instruction:**
English.

**Timing:**
The course unit is held in the spring semester, during period III. It is recommended to complete the course at the end of studies.

**Learning outcomes:**
After completing the course, student
1. can design simple optimal classifiers from the basic theory and assess their performance.
2. can explain the Bayesian decision theory and apply it to derive minimum error classifiers and minimum cost classifiers.
3. can apply regression techniques to practical machine learning problems.

**Contents:**

**Mode of delivery:**
Online teaching, guided laboratory work and independent assignment. The laboratory works are done on an online system (Mathworks Grader). Student can do the lab works remotely or in the lab using the same online system. The course is implemented as remote education via the Moodle work space [https://moodle.oulu.fi/course/view.php?id=5729](https://moodle.oulu.fi/course/view.php?id=5729)

This work space opens to students before the course begins. The student must register to the course in WebOodi in order to participate the course.

**Learning activities and teaching methods:**
Lectures 16 h, Laboratory work 16 h, and Self-study the rest (Independent task assignment).

**Target group:**
Students who are interested in machine learning and pattern recognition theory and methods.

**Prerequisites and co-requisites:**
The mathematic studies of the candidate degree program of computer science and engineering, or equivalent. Programming skills, especially basics of the Matlab.

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Will be informed when the course starts.

**Assessment methods and criteria:**
Laboratory work is supervised by assistants who also verify that the task assignments are completed properly. The Matworks Grader online system also verifies the completed tasks. The independent task assignment is graded which establishes the grade for the course. Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. The final grade is established by the independent task assignment.

**Person responsible:**
Tapio Seppänen

**Working life cooperation:**
No

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521283S: Big Data Processing and Applications, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Computer Science and Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Lauri Lovén
**Opintokohteen kielet:** English
ECTS Credits:
5 ECTS credits

Language of instruction:
English

Timing:
Period IV. It is recommended that the course is taken on the fourth year Spring.

Learning outcomes:
Upon completion of the course, the student:
1. is able to explain the big data phenomenon, its challenges and opportunities.
2. is able to explain the requirements and common principles for data intensive systems design and implementation, and evaluate the benefits, risks and restrictions of available solutions.
3. can explain the principles of big data management and processing technologies and utilize them on a basic level.

Contents:
General introduction into big data, namely: big data fundamentals, data storage, batch and stream data processing, data analysis, privacy and security, big data use cases.

Mode of delivery:
Online teaching, exercises and seminars. Independent and group work.

Learning activities and teaching methods:
Lectures, exercises, seminars, independent and group work

Target group:
M.Sc. students (computer science and engineering) and other Students of the University of Oulu

Prerequisites and co-requisites:
The Bachelor level studies of Computer science and engineering study programmes or respective knowledge.

Recommended optional programme components:

Recommended or required reading:
Lecture slides and exercise material will be provided. Each lecture will include the reference list for recommended reading. Instructions to necessary installations will be given.

Assessment methods and criteria:
This course assesses students continuously by the completion of small project work, seminar presentations and short reports on a selected topic (group work). Answering two quizzes during the course is optional and provides additional points for final grade. To pass the course, it is enough to get 50 % of available points. No exam.

Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Lauri Lovén

Working life cooperation:
The course includes also invited lectures from industry.

Other information:
Course is in Moodle.

811168P: Information Security, 5 op

Voimassaolo: 01.08.2010 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Information Processing Science DP  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Tero Päiväranta  
Opintokohteen kielet: Finnish  
Leikkaavuudet:  
    ay811168P Information Security (OPEN UNI) 5.0 op

ECTS Credits:  
5 ECTS credits / 133 hours of work.

Language of instruction:  
Finnish

Timing:  
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester of the Bachelor's studies.

Learning outcomes:  
After completing the course, the student will be able to:  
* define essential information security concepts and components of information systems security,  
* recognize the common types of security threats, and their managerial and technical protection mechanisms,  
* describe the tasks and responsibilities of information security professionals,  
* explain the different phases of secure systems development/acquisition,  
* recognize the fundamental characteristics of risk management and evaluate information security risks,  
* recognize basics of technical information security methods and cryptography, as well as  
* explain areas of behavioral information security research and their practical implications.

Contents:  
* Basic concepts of information security  
* Information security threats, vulnerabilities, and risks  
* Legal issues and information security frameworks  
* Risk management  
* Cryptography  
* Information security technologies  
* Behavioral information security research

Mode of delivery:  
Blended teaching

Learning activities and teaching methods:  
Lectures and related quizzes or final exam 26 h, weekly assignments and scientific essay 107 h

Target group:  
BSc students.

Prerequisites and co-requisites:  
The required prerequisite is that the learning outcomes of the following courses are accomplished: Introduction to Information Processing Science as well as Devices and Data Network

Recommended optional programme components:  

Recommended or required reading:  

Assessment methods and criteria:  
Weekly assignments. Group or individual assignment.

Grading:  
Numerical scale 1-5 or fail.

Person responsible:  
Tero Päiväranta
521453A: Operating Systems, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Röning
Opintokohteen kielet: English
Leikkaavuudet:
   ay521453A Operating Systems (OPEN UNI) 5.0 op

ECTS Credits:
5

Language of instruction:
In Finnish, material available in English

Timing:
Spring, period 4

Learning outcomes:
1. is capable of explaining the basic structure and functioning of operating system
2. is able to point the problems related to process management and synchronization as well as is able to apply learned methods to solve basic problems
3. is capable of explaining the cause and effect related to deadlocks and is able to analyse them related to common circumstances in operating systems
4. is able to explain the basics of memory management, the use of virtual memory in modern operating systems as well as the structure of the most common file-systems.

Contents:
Operating system structure and services, process management, process synchronization, deadlocks, memory management, virtual memory, file-systems

Mode of delivery:
Face-to-face.

Learning activities and teaching methods:
Lectures 36 h, laboratory exercise 4 h, the rest as independent work. The laboratory work, including pre-exercise and guided exercise performed in a group of one or two students in the unix environment, covers core topics of the course.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
521141P Elementary Programming, 521286A Computer Systems or 521142A Embedded Systems Programming and 521267A Computer Engineering

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
The course is passed the final examination and accepted laboratory working. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Juha Röning (lectures)
Anna-Mari Wartiainen (exercises)

**Working life cooperation:**
-

**Other information:**
-

**031023P: Mathematical Structures for Computer Science, 5 op**

**Opiskelumuoto:** Basic Studies  
**Laji:** Course  
**Vastuuyksikkö:** Applied Mathematics and Computational Mathematics  
**Arvostelu:** 1 - 5, pass, fail  
**Opettajat:** Matti Peltola  
**Opintokohteen kielet:** Finnish  
**Leikkaavuudet:**  
ay031023P Mathematical Structures for Computer Science (OPEN UNI) 5.0 op

**ECTS Credits:**  
5 ECTS credits / 135 hours of work

**Language of instruction:**  
Finnish

**Timing:**  
The course is held in the autumn, during period 1. It is recommended to complete the course at the 2nd autumn semester.

**Learning outcomes:**  
The student is able to apply result of logic to find the truth value of logical statement and can express sentences of natural language by symbols of logic. He/She can use arithmetic operations on different number bases. The student recognize the main types of graphs and understand the basis concepts of graphs and is able to apply formal methods of discrete mathematics to model simple information processing problems.

**Contents:**  

**Mode of delivery:**  
Face-to-face teaching

**Learning activities and teaching methods:**  
Lectures 28 h / Group work 14 h / Self-study 93 h.

**Target group:**  
2. year students of computer science.

**Prerequisites and co-requisites:**  
No prerequisites

**Recommended optional programme components:**  
-

**Recommended or required reading:**  

**Assessment methods and criteria:**
The course can be completed by intermediate exams (2 exams) or by a final exam. Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail

**Person responsible:**
Matti Peltola

**Working life cooperation:**
-

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**521286A: Computer Systems, 8 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuyksikkö:** Computer Science and Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Teemu Leppänen
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**

- 521142A  Embedded Systems Programming  5.0 op

**ECTS Credits:**
8 ECTS cr

**Language of instruction:**
Lecturing in Finnish, course and exercise material available in English.

**Timing:**
Autumn, periods 1-2.

**Learning outcomes:**
Upon completion of the course:
Student understands the basic computer architecture and organization.
Student understands CPU operation and basic datapath operation.
Student knows different number systems and data representations in computers.
Student is familiar of I/O operation with peripheral devices in general.
Student is able to implement small programs with the C programming language for general-purpose computers for embedded systems.
Student is able to implement small assembly language programs.
Student recognizes how embedded systems programming is different from programming general-purpose computers.

**Contents:**
Overview of computer architecture and organization, CPU and datapath, memory hierarchies, data types, interrupts, registers and I/O, basics of the C programming language and basics of assembly language.
Embedded systems programming.

**Mode of delivery:**
Web-based teaching + face-to-face teaching.

**Learning activities and teaching methods:**
Lectures (32h), course exercises (10-30h), laboratory exercise (3h) and two course projects, one is completed in a group and the other alone.

**Target group:**
2nd year students of computer science and engineering and 3rd year students of Electronics and Communications Engineering.

**Prerequisites and co-requisites:**
Elementary programming 521141P.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture notes and exercise material are available in the course website.

Literature:

Assessment methods and criteria:
The assessment criteria is based on the learning outcomes of the course. Students complete the course exercises, participate to the laboratory exercise and complete the course projects. Assessment is based on the exercises and the course projects. More detailed information on assessment is published in the lecture material.

Grading:
Numerical grading scale 1-5, zero stands for fail.

Person responsible:
Teemu Leppänen

Working life cooperation:
Visiting lectures with experts from local industry are possible.

Other information:
The course learning platform is Lovelace (lovelace.oulu.fi).

521043S: Internet of Things, 5 op

Voimassaolo: 01.08.2018 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Ella Peltonen
Opintokohteen kielet: English

Proficiency level:

Status:

ECTS Credits:
5 ECTS / 135 hours of work

Language of instruction:
English

Timing:
Autumn semester during period 2.
Learning outcomes:
Upon completion of the course, the student will be able to:
1. explain application areas of IoT and requirements from such application areas for IoT systems.
2. will be able to explain the state-of-the-art IoT solutions, and understand the basic technologies behind them.
3. learn the principles of the novel IoT technologies and know important directions IoT research towards.

Contents:
The basic technologies and novel applications of the Internet of Things, including networking technologies as well as Web of Things. IoT sensor technologies and sensing solutions for smart buildings including smart home, city, office, or campus environments, and wearables and other personal devices such as fabrication. Exercises will include hands-on programming and sensing data analytics tasks.

Mode of delivery:
The course will be given fully remotely. Please join the Moodle page (https://moodle.oulu.fi/course/view.php?id=5330, password is iot2020) and attend the introduction Zoom lectures in Tue 27.10. 10:15-12 (for general organisation) and Wed 28.10. 14:15-16 (for course project).

Learning activities and teaching methods:
20h lectures, 12h exercise sessions, independent studying 95 hours.

Target group:
M.Sc. students of Computer Science and Engineering, M. Sc. students of Ubicomp International master program. The course fits also for Statistics and Math MSc student interested in applying their knowledge into sensing and IoT data.

Prerequisites and co-requisites:
The Bachelor level knowledge of Computer science and engineering study programmes. Good programming skills in a chosen language.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture hand-out, complementary reading list, and exercise material will be provided.

Assessment methods and criteria:
Attending lectures and exercise sessions, and returning the weekly exercises online.
Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Ella Peltonen

Working life cooperation:
The course may include the invited guest lectures from industry and other top EU universities.

Other information:
Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi.

521348S: Statistical Signal Processing 1, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juntti, Markku Johannes, Janne Lehtomäki
Opintokohteen kielet: Finnish
Leikkaavuudet:

521484A Statistical Signal Processing 5.0 op

ECTS Credits:
5 ECTS

Language of instruction:
English

Timing:
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st semester of the master studies.

Learning outcomes:
Upon completion the student
1. knows the key tools of linear algebra and quadratic optimization and can apply them in solving signal processing problems.
2. understands how to handle complex valued random variables and processes.
3. understands the key concepts in estimation theory such as the classical and Bayesian philosophies.
4. masters the most important estimation principles such as minimum variance, maximum likelihood, least squares and minimum mean square error estimators.
5. can derive an estimator for a given criterion and basic data models.
6. can use the methodology of estimation theory to analyze the performance of estimators and compare to performance benchmarks such as the Cramer-Rao lower bound.
7. understands the basics of detection and classification theory: hypothesis testing, receiver operating characteristics (ROC), the Neyman-Pearson and Bayesian detectors.

Contents:
Review of probability, complex valued random variables and stochastic processes; linear algebra, eigenvalue decomposition, SVD ( Singular value decomposition), use of Matlab; estimation theory, minimum variance unbiased estimator, Cramer-Rao lower bound, linear models, general minimum variance unbiased estimation, best linear unbiased estimators, maximum likelihood estimation, least squares estimation, Bayesian estimation, linear Bayesian estimation; statistical decision theory, receiver operating characteristics, hypothesis testing, matched filter.

Mode of delivery:
Face-to-face teaching and e-learning tool usage

Learning activities and teaching methods:
Face-to-face-teaching (lectures and exercises) 50h, Matlab simulation exercises in groups 30 h, independent work & passed assignment 50 h.

Target group:
Electrical, communications and computer science and engineering students.

Prerequisites and co-requisites:
The required prerequisite is the completion of the following courses prior to enrolling for the course: 031080A Signal Analysis, 031021P Probability and Mathematical Statistics, 031078P Matrix Algebra, 521330A. The recommended prerequisite is the completion of Telecommunication Engineering.

Recommended optional programme components:
521323S Wireless communications I and 031051S Numerical Matrix Analysis are recommended to be taken in parallel.

Recommended or required reading:
Parts from books:
5. Other literature, lecture notes and material.

Assessment methods and criteria:
Completing the simulation project tasks, and a mid-term exam during the course. The mid-term exams can be retaken by a final exam later. In the final grade of the course, the weight for the examination is 0.7 and that of project report 0.3.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero (0) stands for a fail.

Person responsible:
Janne Lehtomäki and Markku Junitti

Working life cooperation:
No

Other information:
Lecture materials etc. can be found on Moodle https://moodle.oulu.fi/course/view.php?id=4203.

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 - 
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
A440264: Complementary Module, Mining Technology and Mineral Processing, 20 - 30 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Supplementary Module
**Laji:** Study module
**Vastuuysikkö:** Field of Industrial Engineering and Management
**Arvostelu:** 1 - 5, pass, fail

Ei opintojaksokuvauksia.

**Electives**

493300A: Principles of mineral processing, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Oulu Mining School
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Saija Luukkanen
**Opintokohteen kielet:** English, Finnish

Leikkaavuudet:
ay493300A  Principles of mineral processing (OPEN UNI)  5.0 op

**ECTS Credits:**
5 ECTS / 133 hours of work

**Language of instruction:**
Finnish; material mainly in English

**Timing:**
2nd period in the autumn. Recommended for the 3rd year students.

**Learning outcomes:**
Upon completion the course the student can explain the main unit process used in ore beneficiation and understands the main chemical and mineralogical factors palying the key role in process development. The student is able to calculate the most relevant process related calculations, such as mass balances, concentrate recoveris and grindability. The student is aware of the environmental as well as H&S aspects of mineral processing.

**Contents:**
The main unit processes used in mineral processing. Understanding how the mineralogy and chemistry of the ore influences in the process development.

**Mode of delivery:**
Mainly face-to-face teaching

**Learning activities and teaching methods:**
Lectures, demonstrations, assignments

**Target group:**
Student with mineral processing as major; students of mining engineering, geosciences and process engineering

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:
The material provided during the course. B.A. Wills: Mineral processing technology

Assessment methods and criteria:
Final exam, home works and practicals, energy

Grading:
1-5/fail

Person responsible:
Saija Luukkanen

Working life cooperation:
No

Other information:
-

493302A: Chemical phenomena in mineral processes, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Saija Luukkanen
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
Finnish, course material in English

Timing:
The course is held in the autumn semester, during period 2. It is recommended to complete the course at the 3rd study year

Learning outcomes:
Upon successfull completion student can explain physical-chemical phenomenons (especially surface and electro chemical) affecting various unit operations in mineral processing. Student can also describe general phases in mineral processing and unit operation from standpoint of physical chemistry.

Contents:
Reaction equilibria, basic equations in thermodynamics; chemical interactions especially at interfaces; electrochemical interactions, effects of chemical phenomena on the unit operations of mineral processing.

Mode of delivery:
Face to face teaching

Learning activities and teaching methods:
32 h lectures and exercices (homework)

Target group:
Students in mining engineering and mineral processing, geosciences or process engineering

Prerequisites and co-requisites:
493300A Principles of Mineral Processing

Recommended or required reading:
Lectures and electronic materials

Assessment methods and criteria:
Final exam, homework exercises, activity

Grading:
1-5/fail

Person responsible:
Prof. Saija Luukkanen, lecturer Docent Jaakko Leppinen

772335A: Introduction to ore mineralogy, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Eero Hanski
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS

Language of instruction:
The language of instruction is English.

Timing:
The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd or 3rd autumn semester.

Learning outcomes:
Upon completion of this course, the student will:
obtain basic knowledge on ore minerals and their mode of occurrence
learn to recognise the most common ore minerals and textures under the ore microscope.

Contents:
Division and structure of ore minerals, composition and texture, phase diagrams and their applications. Ore microscope and how it is used, microscopic properties of ore minerals. Identification of ore minerals and ore mineral assemblages.

Mode of delivery:
Face to face teaching.

Learning activities and teaching methods:
14 h lectures, 21 h exercises.

Target group:
All students in geosciences and mining engineering and mineral processing.

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: 771102P Basic mineralogy, 772339A Optical mineralogy.

Recommended optional programme components:
The course in an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Assessment methods and criteria:
Examinations in both theory and calculations.

Grading:
In the theory exam grade and final grade, the course utilizes a numerical grading scale of 1-5. Zero stands for a fail. In the microscope exam, the course utilizes verbal grading pass/fail.

Person responsible:
Shenghong Yang

Working life cooperation:
No.

493605S: Ore benefication technologies, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English, Finnish

ECTS Credits:
5 ECTS cr /133 hours of work

Language of instruction:
English

Timing:
Autumn semester, period 1. It is recommended to complete the course at the 1st autumn semester of the Master's studies.

Learning outcomes:
Upon completion of the course students should be able to:
- Describe the principles and applications of the main beneficiation technologies
- Recognize the variables affecting the selection of the process techniques
- Understand the characteristics of the feed material and behaviour during physical and chemical beneficiation processes (comminution, flotation, gravity separation and sedimentation processes) and characteristics of the products and waste
- Understand of optimization methods applied in beneficiation plants
- Apply knowledge in practical exercises, carrying out calculation of sample size, efficiencies, balances and basic design of the unit operations that are used in ore processing

Contents:
Module 1: Introduction to Mineral Processing Technology
Module 2: Mineral Characterization Techniques
Module 3: Comminution - Size reduction
Module 4: Beneficiation Technologies - Physical Separation Techniques
Module 5: Physic-chemical separation techniques
Module 6: Solid-Liquid Separation
Module 7: Cu, Fe, Phosphate beneficiation and Optimization in separation processes
Module 8: Seminar (technic, method or process reviewed)
Additionally, it is included Practices in sampling, comminution, flotation, mass balances, lab test calculation (in laboratory or on-line according to the situation)

Mode of delivery:
Classroom education and on-line, practice in laboratory
Learning activities and teaching methods:
Lectures 24h / Practice 16h / Group work 12h / Self-study includes exercises and assignments 75h

Target group:
Students in the study option MEMP Mineral processing, minor subject and other students of the Oulu Mining School and Faculty of Technology

Prerequisites and co-requisites:
493300A Principles in Mineral Processing, 493302A Chemical Phenomena in Mineral processing for Finnish students
Previous courses in Mineral Processing for international students

Recommended optional programme components:
The course is an independent entity and does not require additional studies out at the same time. Review of the material and reading is recommended.

Recommended or required reading:

Assessment methods and criteria:
Continuous assessment during lectures, exercises (participation), reports, papers review, questionnaire self-learning, quizzes
The final assessment method: Seminar peer review and Assignment
Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture and attendance is very important

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Maria Sinche Gonzalez

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

A440255: Supplementary Module, Mechanical Engineering, 20 - 30 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.
462107A: Maintenance of machines, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Mechanical Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Jouni Laurila
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 464087A-01 Maintenance Technology, examination 0.0 op
- 464087A-02 Maintenance Technology, exercise work 0.0 op
- 464087A Maintenance Technology 5.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 3rd spring semester.

**Learning outcomes:**
After completing the course, the student will be familiar with the principles and most common methods of implementing fitness based maintenance. They are able to explain the importance of running in production and apply the most important standards in the field of maintenance. different types of maintenance and can tell you what aspects of choosing a maintenance strategy. The student knows how to name the most common machine failure methods and the consequences of failure and can tell how to prevent failure in typical situations. The student recognizes the effects of wear and lubrication on the condition of machines and is able to explain the basic concepts related to lubricant analysis. The student knows how to use the most common methods used in machine condition monitoring and how to use them. He / she can explain the basics of vibration measurements and can choose appropriate measurement and analysis methods to identify the most common machine failures. The student knows the importance of running in production and is able to apply the most important standards in the field of maintenance.

**Contents:**
Condition based maintenance, failure, wear and lubrication, common condition monitoring methods, basics of performing vibration measurements, analyzing and signal processing, common rotating machine failure detection, vibration intensity estimation, rotor dynamic balancing, machine design and condition, machine design and condition management. failure, wear and lubrication, machine condition monitoring basics and common methods.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 24 h / group work 50 h / self-study 61 h

**Target group:**
Bachelor's degree students in the mechanical engineering

**Prerequisites and co-requisites:**
The recommended prerequisite is the completion of the following course: 462103A Introduction to Maintenance

**Recommended optional programme components:**
The course is an independent entity

**Recommended or required reading:**

Assessment methods and criteria:
Final examination and the other graded assignments

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jouni Laurila

462109S: Simulation and modelling of machines, 8 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Toni Mikael
Opintokohteen kielet: Finnish
Leikkaavuudet:
462055S-01 Virtual Engineering of Mechatronic Products, examination 0.0 op
462055S-02 Virtual Engineering of Mechatronic Products, exercise work 0.0 op
462055S Virtual Engineering of Mechatronic Products 5.0 op

ECTS Credits:
8 cr / 213 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 4th spring semester.

Learning outcomes:
Upon completion of the course, the student will be able to create a simulation model consisting of rigid bodies using Adams and MATLAB/Simulink software. The student is able to interpret the simulation results and is also able to evaluate the validity of the results. The student is able to design submodels of complex systems and he/she is able to explain the principles of creating a more complex simulation model. In addition to this, the student is able to evaluate the extent of modelling process of various kinds of engineering systems.

Contents:
Basics of virtual design; ADAMS simulation software principles and basic usage; Creation and usage of multibody systems comprised of rigid bodies; Kinematic and dynamic analysis; Determination of actuator motion paths and velocities as well as determination of loads; Modelling and simulation of control systems.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 32 h / Group work 32 h / Self-study 149 h

Target group:
Master's degree students of mechanical engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Lecture handout. Other material is in the beginning of the course.

**Assessment methods and criteria:**
This course utilizes continuous assessment. The assessment can be based on learning diary, exercises, seminars and exam. The more detailed assessment criteria are available on the Noppa Study Portal.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Lecturer Toni Liedes

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**521043S: Internet of Things, 5 op**

**Voimassaolo:** 01.08.2018 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Computer Science and Engineering DP
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Ella Peltonen
**Opintokohteen kielet:** English

**Proficiency level:**

**Status:**

**ECTS Credits:**
5 ECTS / 135 hours of work

**Language of instruction:**
English

**Timing:**
Autumn semester during period 2.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
1. explain application areas of IoT and requirements from such application areas for IoT systems.
2. will be able to explain the state-of-the-art IoT solutions, and understand the basic technologies behind them.
3. learn the principles of the novel IoT technologies and know important directions IoT research towards.

**Contents:**
The basic technologies and novel applications of the Internet of Things, including networking technologies as well as Web of Things. IoT sensor technologies and sensing solutions for smart buildings including smart home, city, office, or campus environments, and wearables and other personal devices such as fabrication. Exercises will include hands-on programming and sensing data analytics tasks.

**Mode of delivery:**
The course will be given fully remotely. Please join the Moodle page (https://moodle.oulu.fi/course/view.php?id=5330, password is iot2020) and attend the introduction Zoom lectures in Tue 27.10. 10:15-12 (for general organisation) and Wed 28.10. 14:15-16 (for course project).

**Learning activities and teaching methods:**
20h lectures, 12h exercise sessions, independent studying 95 hours.

**Target group:**
M.Sc. students of Computer Science and Engineering, M. Sc. students of Ubicomp International master program. The course fits also for Statistics and Math MSc student interested in applying their knowledge into sensing and IoT data.

**Prerequisites and co-requisites:**
The Bachelor level knowledge of Computer science and engineering study programmes. Good programming skills in a chosen language.

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Lecture hand-out, complementary reading list, and exercise material will be provided.

**Assessment methods and criteria:**
Attending lectures and exercise sessions, and returning the weekly exercises online. Read more about [assessment criteria](https://ouluwebpage) at the University of Oulu webpage.

**Grading:**
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Ella Peltonen
Working life cooperation:
The course may include the invited guest lectures from industry and other top EU universities.

Other information:
Course work space can be found from University of Oulu Moodle platform moodle.oulu.fi.

Machine Design

462103A: Introduction to Maintenance, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouni Laurila
Opintokohteen kielet: Finnish
Leikkaavuudet:
   464087A-01 Maintenance Technology, examination 0.0 op
   464087A-02 Maintenance Technology, exercise work 0.0 op
   464087A Maintenance Technology 5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

Learning outcomes:
After completing the course, students will be able to explain key concepts related to the maintenance industry, define what maintenance is, and describe its most important impacts on productivity, safety and the environment. The student will be able to name the levels of maintenance activities and describe what aspects are involved in choosing a maintenance strategy. After the course the student is able to calculate the most important reliability indicators and evaluate the overall efficiency of production equipment and the factors affecting it and classify maintenance activities as corrective and preventive. The student is able to explain what issues and practices are essential for keeping the production assets in good condition. The student can also take into account maintenance related issues in different planning tasks.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
More detailed performance methods are given at the start of the course.
Target group:
Bachelor's degree students in the mechanical engineering

Recommended optional programme components:
The course is an independent entity.

Recommended or required reading:
Lecture handout and the other material delivered during the course. Supplementary readings: Järviö, J., Kunnossapito. Helsinki, KP-Media Oy / 2012.

Assessment methods and criteria:
Final examination and the other graded assignments

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jouni Laurila.

462101A: Information technology and machines, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Toni Mikael
Opintokohteen kielet: Finnish

ECTS Credits:
5 cr / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2nd spring semester.

Learning outcomes:
Upon completion of the course, the student will be able to explain how the information technology is utilized in modern machines. The student is able to describe how the modern machines are developed from purely mechanical systems to multi-disciplinary systems. The student is able to sort out the electrical, information technological and mechanical features of modern machines. He/she is also able to describe the interaction and interfaces of the aforementioned features. In addition to this, the student is able to separate the digital and analog domains. The student is able to create a simple computer program for machine control. He/she is able to name the sensors and actuators being used in automated machines. Furthermore, the student is able to list examples of machines taking advantage of modern information technology.

Contents:
History of mechanical engineering and information technology; Information technology as an enabler of the development of machines; Requirements and boundary conditions for automatisation of machines; Concepts of information technology and electronics; Basics of programming and logical reasoning; Examples of machine applications taking advantage of modern information technology.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 20 h / Group work 12 h / Self-study 101 h

Target group:
Bachelor's degree students of mechanical engineering
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Lecture notes. Other material is in the beginning of the course.

Assessment methods and criteria:
This course utilizes continuous assessment. During the course there are exercises and intermediate exams. The exercises and the exams will be assessed. The assessment of the course is based on the learning outcomes of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Lecturer Toni Liedes

462102A: Machine automation actuators, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Louhisalmi, Yrjö Aulis
Opintokohteen kielet: Finnish
Leikkaavuudet:

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<td>462021A-02</td>
<td>Machine Automation I, exercise work</td>
<td>0.0 op</td>
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<td>462021A</td>
<td>Machine Automation I</td>
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<tr>
<td>464064A</td>
<td>Actuators</td>
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ECTS Credits:
5 cr / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 3 and 4. It is recommended to complete the course at the 2nd spring semester.

Learning outcomes:
After completing the course the student can explain the role of actuators in machine automation systems. The student recognizes different types of actuators and can categorize them e.g. based on performance and usage limitations. The student is able to design a simple actuator operation and is able to select suitable actuators for a typical automation application. In addition, the student is able to evaluate the sensing needs and operating conditions of actuators as part of the automation system.

Contents:
Basics actuators; Basics of hydraulics, Pneumatics and electrical drives; Performance and efficiency of actuators; Hydraulic actuators; Pneumatic actuators; Electrical actuators.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 32 h / Group work 16 h / Self-study 85 h

Target group:
Bachelor's degree students of mechanical engineering

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Lecture materials. Other material is in the beginning of the course.

**Assessment methods and criteria:**
This course utilizes continuous assessment. The assessment can be based on learning diary, homework, exercises, seminars and exam.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University teacher Yrjö Louhisalmi

**464105S: Computer aided design, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuyksikkö:** Field of Mechanical Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 462044S-01 Computer Aided Design, examination 0.0 op
- 462044S-02 Computer Aided Design, exercise work 0.0 op
- 462044S Computer Aided Design 3.5 op

**ECTS Credits:**
5 ects / 133 hours of studying work.

**Language of instruction:**
Finnish, can be completed in English as a book examination.

**Timing:**
Lectures and exercises arranged spring during periods 3. Recommended date of performance 4th year spring.

**Learning outcomes:**
After completing the course, the student will know modern CAD/CAE tools, simulation and virtual validation possibilities with CAD/CAE systems. The best procedures in various design tasks have also become familiar. In addition, the student is familiar with the theory behind CAD systems related to the geometry of models and their modification. In addition, the student also has a basis for product information management and the use of design data in PDM/PLM systems.

**Contents:**
The course includes product design and product validation on a computer-aided basis. During the course, you will get acquainted with the possibilities of product design and validation of functionality using CAD /CAE systems. Use of the computer in design functions and the applicable systems. Parametricity and customizability of the product play an important role. In addition, students learn what special tools design software offers.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 20 h/ exercises 30 h/ practical assignment 83 h. Exercises are carried out independently and the assignment in small groups.

**Target group:**
Master's Degree student of mechanical engineering, specially students studying Machine Design.

**Prerequisites and co-requisites:**
Recommended optional programme components:
The course is an independent entity and does not require other studies to be completed at the same time.

Recommended or required reading:

Assessment methods and criteria:
Final exam, lecture exercises and exercise work. For the final grade, the exam has a weight factor of 0.4; for lecture exercises, 0.2; and for exercise work, 0.4.

Grading:
Numerical grading scale 1-5 / fail

Person responsible:
Jussi Salakka

462105A: Machine Sensor Technology, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Toni Mikael
Opintokohteen kielet: Finnish
Leikkaavuudet:
   462053A Sensor Technology of Machine Automation 5.0 op

ECTS Credits:
5 cr / 133 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

Learning outcomes:
Upon completion of the course, the student will be able identify, classify and bring into use the most common sensor types used in machine automation. The student is able to choose sensors for typical automation applications. In addition to this, the student is able to design a common analog and digital signal transmission and conditioning chain.

Contents:
Basics measuring systems; Classification of sensors; Characteristics of analog and digital domain; Analog to digital conversion; Basics of analog signal conditioning: amplification, attenuation and filtering; Operating principle of digital sensors; Examples of typical sensors used in mechanical engineering and civil engineering;

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 32 h / Group work 16 h / Self-study 85 h

Target group:
Bachelor's degree students of mechanical engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: Actuators in Machine Automation
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, exercises, seminars and exam.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Lecturer Toni Liedes

462111S: Machine diagnostics, 10 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouni Laurila
Opintokohteen kielet: Finnish
Leikkaavuudet:

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<td>Diagnosis of Machine Condition</td>
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<td>Diagnosis of Machine Condition, examination</td>
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<tr>
<td>464088S-02</td>
<td>Diagnosis of Machine Condition, exercises</td>
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ECTS Credits:
10 ECTS credits / 270 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 4th spring semester.

Learning outcomes:
After completing the course the student will be able to use various methods of machine diagnostics and use the most common measuring devices to determine the functioning and condition of machines. He / she is able to apply the key indicators and signal processing methods used in condition monitoring and to analyze the frequency content of signals in order to solve problems related to the operation of machines. They will be able to draw up a measurement plan, make measurements, analyze the data obtained and report the results obtained. He / she is also able to evaluate what factors affect the reliability and comparability of measurements. The student is able to use industry standards to help evaluate the condition of machinery and the vibration intensity. They will be able to understand the importance of machine diagnostics in the success and productivity of maintenance.

Contents:
Major methods and measurement techniques used in machine diagnostics, machine vibration analysis and fault detection, key signal processing methods, measurement design, implementation and reporting, machine balancing, industry standards.

Mode of delivery:
Face-to-face teaching

Target group:
Master's degree students in the mechanical engineering
Prerequisites and co-requisites:
The recommended prequisite is the completion of the following course: 462107A Maintenance of Machines, 462105A Sensor technology for Machines.

Recommended optional programme components:
The course is an independent entity.

Recommended or required reading:

Assessment methods and criteria:
Final examination and the other graded assignments

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jouni Laurila

Mechatronics

521077P: Introduction to Electronics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Jari Hannu
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay521077P Introduction to Electronics (OPEN UNI) 5.0 op
  521209A Electronics Components and Materials 2.0 op

ECTS Credits:
5 ECTS credits / 132,5 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the 1st period. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:
1. Student understands the block structures of electronic devices and their signal processing paths.

2. Student can identify the interfaces of analog and digital electronics and the software operations.

3. Student is able to identify and classify electronics components and compare their properties.

4. Students can describe electric conductivity and apply the phenomenon on designing and choosing resistors.

5. Student is able to estimate the difference between dielectric materials and how they affect the properties of a capacitor.

6. Student can compare properties of magnetic materials and how identify they effect on inductive components.
7. Student can identify semiconductivity and is able to list typical semiconductor components.

8. Student can classify different circuit board techniques and is able to choose proper coupling techniques.

9. Student can identify the future technologies of electronics materials.

Contents:

Mode of delivery:
Face-to-face teaching and independent work.

Learning activities and teaching methods:
The implementation methods of the course vary. The course will be arranged utilizing activating teaching methods agreed on together with the students. There will be 48 hours of guided teaching events and 84.5 hours of teaching without guidance either privately or in a group.

Target group:
First year electrical engineering students.

Prerequisites and co-requisites:
No prerequisites.

Recommended optional programme components:
-

Recommended or required reading:
Lecture material; Materials science and engineering: an introduction / Willam D. Callister, chapters 1, 18 and 20; Electronic components and technology / S. J. Sangwine. Chapters 1,2,3,5 and 7

Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are two intermediate exams. In addition students will make course work which are graded. The assessment of the course is based on the learning outcomes of the course. Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Jari Hannu

Working life cooperation:
No

Other information:
-
**Learning outcomes:**
After the course the student can

1. write and solve the equations describing the operation of a given electrical circuit
2. solve the sinusoidal steady-state solution using complex phasor arithmetics
3. solve time responses of electric circuits
4. simplify electrical circuits e.g. using equivalent circuits
5. simulate simple circuits and choose an appropriate circuit simulation method

**Contents:**

**Mode of delivery:**
Classroom.

**Learning activities and teaching methods:**
30h lectures, 22h exercises, and a simulation exercise.

**Target group:**
Finnish BSc students.

**Prerequisites and co-requisites:**
Matrix algebra, complex arithmetics, differential equations.

**Recommended optional programme components:**
Background to all analog electronics courses.

**Recommended or required reading:**

**Assessment methods and criteria:**
Final exam. Also the simulation exercise must be passed
Read more about [assessment criteria](#) at the University of Oulu webpage..

**Grading:**
1-5

**Person responsible:**
Prof. Timo Rahkonen

**Working life cooperation:**
-

**Other information:**
-

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**461106A: Dynamics, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Mechanical Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Koivurova Hannu
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
461018A-01 Dynamics, examination 0.0 op
461018A-02 Dynamics, exercises 0.0 op
ECTS Credits:
5 ECTS credits / 120 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2nd spring semester.

Learning outcomes:
The aim of this course is to provide students with the ability to examine the relationship between the forces on a solid body and the resulting motion, position, speed and acceleration of the body. Learning outcomes:
Upon completing the required coursework, the student knows and is able to explain the fundamental quantities and the base laws of the classical mechanics. He/she is able to choose an appropriate coordinate system and analyze the motion - position, velocity, and acceleration - of the parts of a device. The student is able to draw a free body diagram of a moving system, and compose and derive the equations of motion for a system using the direct momentum method, the work-energy method, and the impulse-momentum method.

Contents:
Introduction; Kinematics of a particle; Plane kinematics of a rigid body; Kinetics of a particl; Basics of mechanical vibrations; Kinetics of a system of particles; Plane kinetics of a rigid body.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 45 h / Exercise 30 h / Self-study 45 h.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are three intermediate exams. In addition to this, the students will be asked to calculate homeworks, and theses homeworks will be assessed. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Moodle Study Portal.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University Lecturer Hannu Koivurova
ECTS Credits:
8 cr / 213 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 5th autumn semester.

Learning outcomes:
Upon completion of the course, the student will be able to analyze and design mechatronic products using modern calculation and simulation methods. The student is able to choose the appropriate technology for a mechatronic system. He/she is also able to compare the various technologies. In addition to this, the student is able to assess the feasibility, performance and preconditions of different kinds of actuators in mechatronic products.

Contents:
Technology of digital control systems; Characteristics of dynamical systems and their behavior in time and frequency domain; Modelling and simulation of mechatronic systems; Basics of advanced vibration damping systems and their control; Modelling of friction; Experimental research of mechatronic systems.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Lectures 16 h / Group work 32 h / Self-study 165 h

Target group:
Master's degree students of mechanical engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: Actuators in Machine Automation, Mechatronics, Simulation and Modelling of Machines

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Assessment methods and criteria:
This course utilizes continuous assessment. The assessment can be based on learning diary, exercises, seminars, assignment and exam. The more detailed assessment criteria are available on the Noppa Study Portal.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Lecturer Toni Liedes

521160P: Introduction to Artificial Intelligence, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Riku Hietaniemi
Opintokohteen kielet: English
Leikkaavuudet:
ay521160P Introduction to Artificial Intelligence (OPEN UNIV) 5.0 op
ECTS Credits:
5 ECTS credits /135 hours of work

Language of instruction:
Finnish, English
Lectures and main material in Finnish. English material for self study available.

Timing:
Period IV in spring semester. Recommended completion year: first or second.

Learning outcomes:
Upon completion the student will have the elementary skills to identify the potentially applicable artificial intelligence techniques for solving problems. He/she can recognize search, regression, classification, and clustering problems, and to explain the use of supervised and nonsupervised learning, performance measurements and metrics.

Contents:
- Introduction to artificial intelligence
- Search methods
- Supervised learning
- Regression
- Classification
- Data preprocessing
- Unsupervised learning
- Reinforcement learning
- Neural networks

Mode of delivery:
Face-to-face teaching. Online learning option available.

Learning activities and teaching methods:
Mode of delivery: Online teaching. Lectures 42h / exercise work 70 h / self-study 23 h. The exercises can be completed individually or as group work in multi-disciplinary teams.

Target group:
All Bachelor level students.

Prerequisites and co-requisites:
No prerequisites. Python programming skills are highly recommended.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
All course material (lectures and exercises) are available in course Moodle space.

Assessment methods and criteria:
The course utilizes continuous assessment. During the course there are five intermediate exams which will be used in final evaluation. The course also includes five exercises of which at least four need to be passed. These exercises can be completed individually or in groups.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Riku Hietaniemi

Working life cooperation:
Experts from industry are invited to present real world artificial intelligence solutions.

Other information:
Course learning environment is in Moodle moodle.oulu.fi.

Production engineering

462104A: Machine automation, 5 op
Voimassaolo: 01.08.2015 -  
Opiskelumuoto: Intermediate Studies  
Laji: Course  
Vastuuysikkö: Field of Mechanical Engineering  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Louhisalmi, Yrjö Aulis  
Opintokohteen kielet: Finnish  
Leikkaavuudet:  
462022S-01 Machine Automation II, examination 0.0 op  
462022S-02 Machine Automation II, exercise work 0.0 op  
462022S Machine Automation II 5.0 op  

ECTS Credits:  
5 cr / 133 hours of work  
Language of instruction:  
Finnish  

Timing:  
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.  

Learning outcomes:  
Upon completion of the course, the student will be able to explain the basic principles and structures of a typical machine automation system. The student is able to divide an automation system into basic elements and explain their role and significance in the system. The student can apply the basic digital technology and logic methods in designing a typical machine automation system. In addition to this, the student knows the operating principles of programmable logic controllers (PLCs) and is able to implement a logic control for a typical application. Furthermore, the student is able to explain the basic principles of fieldbuses. The students also knows the basics of machine automation safety design.  

Contents:  
Basics of automation; Basics of digital technology and logic; Description of operation sequences; Architecture of programmable logic controllers and their programming; Distributed systems and fieldbuses.  

Mode of delivery:  
Blended teaching  

Learning activities and teaching methods:  
Lectures 32 h / Group work 16 h / Self-study 85 h  

Target group:  
Bachelor's degree students of mechanical engineering  

Prerequisites and co-requisites:  
The recommended prerequisite is the completion of the following courses prior to enrolling for the course: Actuators in Machine Automation, Elementary Programming  

Recommended optional programme components:  
The course is an independent entity and does not require additional studies carried out at the same time. However, it is recommended to complete the course Machine Sensor Technology simultaneously.  

Recommended or required reading:  
Lecture material. Other material is in the beginning of the course.  

Assessment methods and criteria:  
This course utilizes continuous assessment. The assessment can be based on learning diary, homework, exercises, seminars and exam.  

Grading:  
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.  

Person responsible:  
University teacher Yrjö Louhisalmi
463104A: Advanced manufacturing methods, 7 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jyri Porter
Opintokohteen kielet: Finnish
Leikkaavuudet:
   463068S-01 Laser Processing, examination 0.0 op
   463068S-02 Laser Processing, exercises and seminar 0.0 op
   463068S Laser Processing 3.5 op

ECTS Credits:
7 cr / 187 hours of work

Language of instruction:
Finnish, the course can also be completed in English

Timing:
Organized during the autumn semester. Lectures and seminar during period 1, demonstrations and practical work during period 2.

Learning outcomes:
The student can apply laser machining processes, electrical discharge machining, abrasive water jet cutting and additive manufacturing processes in today's machine shops as well as choose suitable equipment for various applications. The student can also describe the main features, capabilities, limitations and trends of the aforementioned processes.

Contents:
Classes and seminars deal with the fundamentals and equipment of laser material processing, electrical discharge machining, abrasive water jet cutting and additive manufacturing processes. Other processes may be added as deemed suitable. Material interaction, process and equipment possibilities and limitations. Additionally, safety and health aspects of the processes are covered.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
The course consists of lectures and seminars 46h, preparation for the seminars 34h, demonstrations 10h, practical work as a group project 70h, final exam 3h and preparation for the exam 24h. The project work is flexible and enables realization of student-initiated project ideas.

Target group:
Mechanical engineering students in their Bachelor's studies, 3rd year.

Recommended optional programme components:
Production technology studies in general.

Recommended or required reading:

Assessment methods and criteria:
Final exam. The final grade is based on the combined points from the exam (0.4), seminar and practical work (0.6).

Grading:
1 to 5, zero denotes failure to pass.

Person responsible:
Jyri Porter
Other information:
The course objective is to familiarize students especially with methods for manufacturing parts used in mechanical engineering. Methods covered in the course are alternative or supplementary to traditional manufacturing methods.

463109S: Computer aided manufacturing, 7 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouko Heikkala
Opintokohteen kielet: Finnish

Leikkaavuudet:
463059S-01 Computer aided manufacturing, examination 0.0 op
463059S-02 Computer aided manufacturing, exercise work 0.0 op
463059S Computer Aided Manufacturing 4.0 op

ECTS Credits:
7 ECTS

Language of instruction:
Finnish

Timing:
Lectures and exercises at period 2.

Learning outcomes:
The aim of the course is to introduce the students to the methods and systems used in Computer Aided Manufacturing (CAM) through lectures, demonstrations and personal exercises. After the course the student will be able to use computer-assisted methods and systems in connection with the various manufacturing processes of the workshops. The student is able to describe the main features, possibilities and limitations of methods and systems, as well as trends in the field. In addition, he / she can apply his / her knowledge to solve practical problems.

Contents:
Different areas of digital engineering and their interfaces. Computer aided programming and simulation of numerically controlled (NC) machine tools used in manufacturing and the various steps of generating and processing control data. Connection of machine tools to NC programming systems and manufacturing systems. Industrial robots and workshop automation. Analysis and software correction of machining errors. Methods for measuring surface and shape. Methods of rapid preparation and their use. The exercises will introduce you to the areas of computer-aided manufacturing and apply the information to solve various practical problems.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures and assignments. There are three different CAM programs used for teaching: Dassault Systems Cat, Siemens NX and Autodesk Inventor.

Prerequisites and co-requisites:
463102A Production Technology I.

Recommended or required reading:

Assessment methods and criteria:
Final exam. The final grade is based on the combined points from the exam (grade 0.6) and exercises (grade 0.4).

**Grading:**
Numerical grading scale 1-5.

**Person responsible:**
Jouko Heikkala

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### 555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

- **Voimassaolo:** 01.08.2015 -
- **Opiskelumuoto:** Advanced Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajan:** Osmo Kauppila
- **Opintokohteen kiele:** Finnish
- **Voidaan suorittaa useasti:** Kyllä

**Person responsible:**
University lecturer Osmo Kauppila

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### A440249: Supplementary Module, Process Engineering, 20 - 30 op

- **Voimassaolo:** 01.08.2005 -
- **Opiskelumuoto:** Supplementary Module
- **Laji:** Study module
- **Vastuuysikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opintokohteen kiele:** Finnish

Ei opintojaksokuvauksia.

**Process engineering**

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### 477304A: Separation Processes, 5 op

- **Voimassaolo:** 01.08.2005 -
- **Opiskelumuoto:** Intermediate Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Process and Environmental Engineering
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajan:** Muurinen, Esa Ilmari
- **Opintokohteen kiele:** Finnish
- **Leikkaavuudet:**
  - 470323A Separation Processes 5.0 op

**ECTS Credits:**
5 ECTS / 133 hours of work

**Language of instruction:**
Finnish, can be completed in English as a book examination.

**Timing:**
Implementation in autumn semester during the 2nd period. It is recommended to complete the course on the third (Bachelor's) autumn semester.
Learning outcomes:
After the course the student is able to define the position of separation processes based on mass transfer in process and environmental engineering. He/she is capable of solving phase equilibrium problems in multistage separations for binary mixtures. The student is able to explain the phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. He/she recognises the equipment used for these processes and is able to compare the methods to each other with heuristic rules.

Contents:
Separation processes based on mass transfer in process and environmental engineering. Phase equilibrium problems in multistage separations for binary mixtures. Phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. Equipment used for these processes and is able to compare the methods to each other with heuristic rules, etc.

Mode of delivery:
Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:
Lectures 40 h, exercises 20 h, homework 15 h and self-study 58 h. For foreign students written examination based on given literature and homework.

Target group:
Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:
Courses 477301A Momentum Transfer, 477302A Heat Transfer and 477303A Mass Transfer; or 477052A Fluid Mechanics and 477312A Heat and Mass Transfer are recommended beforehand.

Recommended optional programme components:
This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Assessment methods and criteria:
Examination. The course can be completed with three intermediate exams or one final exam. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Laboratory manager Dr Esa Muurinen.

Working life cooperation:
No

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ahola, Juha Lennart
Opintokohdeen kielet: English
Leikkaavuudet:

480310A  Fundamentals of Process Design  5.0 op

ECTS Credits:
5 ECTS /133 hours of work

Language of instruction:
English

Timing:
Period 4

Learning outcomes:
The student is able to identify the activities of process design and the know-how needed at different design stages. The student is capable of utilising process synthesis and analysis tools for creating a preliminary process concept and pointing out the techno-economic performance of the process concept based on holistic criteria.

Contents:
Acting in process design projects. Safety and environmentally conscious process design. Design tasks from conceptual process design to plant design, especially the methodology applicable for preliminary process and plant design.

Mode of delivery:
Lectures and process design exercises in groups.

Learning activities and teaching methods:
Lectures 30 h, group work 50 h and self-study 50 h.

Target group:
Bachelor students in Process and Environmental Engineering.

Prerequisites and co-requisites:
Objectives of 477202A Reactor analysis and 477304A Separation processes.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
Combination of a final exam or two midterm exams and group design exercises.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:
Scale 0-5

Person responsible:
Dr Jani Kangas

Working life cooperation:
-

Other information:
-

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
**Course:** Catalytic Processes 5.0 op

**ECTS Credits:**
5 ECTS / 133 hours of work

**Language of instruction:**
English

**Timing:**
Implementation in autumn semester, during 1st period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

**Learning outcomes:**
Student recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes, energy production, and environmental engineering. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, and the importance of catalyst research.

**Contents:**

**Mode of delivery:**
Lectures including design exercises, face-to-face teaching.

**Learning activities and teaching methods:**
Lectures 20 h, exercises 10 h, teamwork presentations 20 h, portfolio work 40 h and self-study 60 h.

**Target group:**
Master's degree students of the Process and Environmental Engineering study programmes.

**Prerequisites and co-requisites:**
488212A Katalyysin perusteet or 488309A Biokatalyysi

**Recommended or required reading:**
-

**Assessment methods and criteria:**
Portfolio and written examination

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Satu Pitkäaho and Esa Turpeinen

**Working life cooperation:**
No

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**477204S: Chemical Engineering Thermodynamics, 5 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Field of Process and Environmental Engineering

**Arvostelu:** 1 - 5, pass, fail
Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS /135 hours of work

Language of instruction:
Finnish

Timing:
Period 1 (autumn term)

Learning outcomes:
By completing the course, the student understands classical thermodynamics from a chemical engineering viewpoint. Especially she/he can explain the pVT behaviour of pure substances and understands the thermodynamic properties of mixtures. The student can classify the thermodynamic models describing, for example, liquid mixtures. The student can select appropriate models for gas, vapour and liquid phases. In addition, the student can solve process models, phase equilibrium and chemical reaction equilibrium problems, and more generally, is able to evaluate chemical processes using thermodynamic analysis tools.

Contents:
Mass and energy balances, pVT behaviour of pure substances, thermodynamic properties of fluids, chemical reaction equilibrium, vapour/liquid equilibrium, introduction to the use of Aspen Plus in the calculation of a thermodynamic equilibrium state, calculation of thermodynamical state functions, thermodynamic analysis of processes.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 46 h and self-study 87 h

Target group:
Students in the study options of Chemical Engineering, and Bioproducts and bioprocesses.

Prerequisites and co-requisites:
Essential contents of 477401A Thermodynamic equilibria course, or equivalent knowledge on the basic concepts of thermodynamic equilibria.

Recommended or required reading:

Assessment methods and criteria:
Combination of a final exam and home exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Dr Jani Kangas

Working life cooperation:
No

Other information:
-

Process Engineering B

477123S: Chemical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohteen kielet: English
Leikkaavuudet:
    477104S  Chemical Processing of Biomasses  3.0 op

ECTS Credits:
5 ECTS /133 h of work

Language of instruction:
English

Timing:
Implementation in autumn period 1

Learning outcomes:
Upon completion of the course, a student should be able to explain the value chain of chemical processing
of renewable lignocellulosic raw materials to pulp and different end-products. A student is able to identify
lignocellulosic raw materials, their properties, their main components and utilization potential of
components. The student also identifies the unit operations of chemical pulping processes, can explain
their operational principles and their objectives in the process and their role in end product properties.
Besides cellulose fibre production, the student get familiar with novel bioproduct applications.

Contents:
Lignocellulosic raw materials, fundamentals of chemical pulping, recovering of chemicals in kraft pulping,
fiberline in kraft pulping, side products, environmental aspects and novel applications.

Mode of delivery:
Blended teaching.

Learning activities and teaching methods:
Lectures and exercises max. 20 h, homework and self-study 113 hours.

Target group:
Students interested in bioeconomy.

Prerequisites and co-requisites:
488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended optional programme components:
-

Recommended or required reading:
2, book 20: Biorefining of Forest Resources. Lecture materials and other materials that will be announced
at the lectures.

Assessment methods and criteria:
This course utilizes continuous assessment including intermediate exam with web learning and homework.
Read more about the course assessment and grading systems of the University of Oulu at https://www.
oulu.fi/forstudents/assesment-criteria

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta

Working life cooperation:
A visit/excursion to the local pulp mill and/or visiting lecturers from the industry, when feasible.

Other information:
-
477124S: Mechanical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohteen kielet: English
Leikkaavuudet: 477105S Mechanical Processing of Biomasses 3.0 op

ECTS Credits:
5 ECTS / 133 h of work

Language of instruction:
English

Timing:
Implementation in autumn period 2.

Learning outcomes:
Upon completion of the course, a student should be able to explain the value chain of mechanical and chemimechmical processing of renewable lignocellulosic raw materials. Upon completion of the course, a student should be able to identify the unit operations of mechanical and chemi-mechanical pulping process and can explain their operational principles. The student can evaluate the raw material properties and importance of different unit processes on the quality of the end products. In addition, the student can compare fibre properties of different mechanical and chemi-mechanical pulps and wood powders and can explain their effects on the quality of the end product. Student can explain production principle of engineered wood, biocomposites and pelletizing.

Contents:
Processing of wood, mechanical fibres, wood powders: raw material properties, mechanical and chemimechanical defibering, screening, bleaching, biomass micronization and pulverization, the production of engineered wood, wood-plastic composites and pellets. End product properties.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
The implementation methods of the course vary. Lectures and exercises max. 34 h, web learning and self-study 99 h. A part of the teaching can be replaced by group work or home work.

Target group:
Students interested in bioeconomy.

Prerequisites and co-requisites:
488052A Introduction to Bioproduct and Bioprocess Engineering is recommended

Recommended or required reading:
Book series: Fapet Oy. Papermaking Science and Technology, book 5: Mechanical Pulping. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:
This course utilizes continuous assessment including intermediate exam(s) with potential web learning and homework. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Elisa Koivuranta
Working life cooperation:
Visiting lecturers from the industry and/or a visit/excursion to a local manufacturing site, when feasible.

477126S: Manufacturing of fibre products, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Elisa Koivuranta
Opintokohdeen kiele: Finnish
Leikkaavuudet:
477107S Paper Manufacture 3.0 op
477106S Recycled Fiber Processes 3.0 op

ECTS Credits:
5 ECTS / 133 h of work

Language of instruction:
Finnish

Timing:
Implementation in spring period 4.

Learning outcomes:
Upon completion of the course, a student should be able to identify the unit operations paper and board manufacturing and can explain their purpose of use. The student can name the most important chemicals, fillers and coating pigments and can explain their importance in paper and board making. The student can present the essential properties of papermaking fibres, the structure and properties of paper and board, as well as different paper and board grades. The student knows the fundamentals of printing technology and identifies paper properties essential for printing.

Contents:
Properties of fibers, web forming, chemicals in paper manufacture, coating process, structure and properties of paper, paper processing, paper grades, and fundamentals of printing technology.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (in Finnish) 42 h, a written case study as group work, which is presented to course participants, 40 h. Excursion to local paper mill and printing laboratory 3 h. Self-study 48 h.

Target group:
Students interested in bioeconomy.

Prerequisites and co-requisites:
488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended or required reading:
Book series: Fapet Oy, Papermaking Science and Technology, books 8-11, and 13. Lecture materials and other materials that will be announced at the lectures. Separate study material for the English book exam for foreign students.

Assessment methods and criteria:
Examination and other evaluation methods.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Elisa Koivuranta

**Working life cooperation:**
Lecturer from the industry.

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**477128S: Circular Bioeconomy, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Process and Environmental Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Elisa Koivuranta

**Opintokohteen kielet:** English

**Leikkaavuudet:**
- ay477128S Circular Bioeconomy (OPEN UNI) 5.0 op
- 477125S Recycling of bioproducts 5.0 op
- 477106S Recycled Fiber Processes 3.0 op

**ECTS Credits:**
5 cr

**Language of instruction:**
English

**Timing:**
Implementation in the spring period 3.

**Learning outcomes:**
Upon completion of the course, a student should be able to recognize the incentives for the recycling of bioproducts and residues from forest industry. Student is familiarized with circular bioeconomy at the state-of-art level. Student is able to identify the challenges (properties, transportation ect.) of raw materials and their processing, can propose solutions and has ability to review the sustainability of final products.

**Contents:**
Reuse, recycling and utilization of bioproducts and side streams of forest industry in accordance with principles of circular bioeconomy. The properties and processing of raw material. Novel applications in circular bioeconomy.

**Mode of delivery:**
Lectures, group meetings and project work.

**Learning activities and teaching methods:**
Work load in the course is totally 133h. The number of lectures can vary but project working is main activities in the course.

**Target group:**
Students interested in circular bioeconomy.

**Prerequisites and co-requisites:**
488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

**Recommended or required reading:**
Lecture materials and other materials that will be announced at the lectures.

**Assessment methods and criteria:**
The assignment and seminar. More information about assessment methods is given during the course.

**Grading:**
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Elisa Koivuranta

Working life cooperation:
Visiting lecturers from the industry, when feasible.

Other information:
This Course replace course 477125S Recycling of bioproducts, 5 cr.

Automation engineering

477621A: Control System Analysis, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Hiltunen, Jukka Antero
Opintokohteen kielet: Finnish
Leikkaavuudet:
   477602A   Control System Analysis   4.0 op

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:
Period 1 (autumn term)

Learning outcomes:
After completing the course the student can describe the process dynamics with mathematical and graphical methods. The student can independently: form linear process models, analyse linear system stability, Bode diagrams, Routh's stability criterion and the Jury's test, and evaluate the behavior of processes through time and frequency range specifications.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises

Target group:
B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:
The courses 477011P Introduction to process and environmental engineering I, 488010P Introduction to process and environmental engineering II, and 477051A Automation engineering recommended beforehand

Recommended optional programme components:
None

Recommended or required reading:
Assessment methods and criteria:
Exam and in addition extra points from homeworks

Grading:
Numerical grading scale 1-5 or fail

Person responsible:
Jukka Hiltunen ja Enso Ikonen

Working life cooperation:
No

477622A: Control System Design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ikonen, Mika Enso-Veitikka
Opintokohteen kielet: Finnish
Leikkaavuudet:
    477603A Control System Design 4.0 op

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:
Period 3 (spring term)

Learning outcomes:
After completing the course the students can apply mathematical and graphical methods to the dynamics of process characterisation and control design. The student can form PID controllers for the process, and tune them and evaluate the closed-loop requirements.

Contents:
Laplace-level vs, time level, poles of the system, closed loop and its design specifications, PID control and tuning, Matlab control designer tool, control design in frequency domain.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises

Target group:
B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:
The courses 477011P Introduction to process and environmental engineering I, 488010P Introduction to process and environmental engineering and 477602A Control system analysis recommended beforehand

Recommended optional programme components:
None

Recommended or required reading:

Assessment methods and criteria:

Exam

Grading:
Numerical grading scale 1-5 or fail

Person responsible:
Professor Enso Ikonen and university teacher Seppo Honkanen

Working life cooperation:
No

477524S: Process Optimization, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Aki Sorsa
Opintokohteen kielet: Finnish
Leikkaavuudet:
  ay477524S  Process Optimization (OPEN UNI)  5.0 op
  477504S  Process Optimization  4.0 op

ECTS Credits:
5 ECTS /135 hours of work

Language of instruction:
English

Timing:
Spring semester, the 3th period. Recommended for 1st year M.Sc. students.

Learning outcomes:
Student can use and apply standard unconstrained and constrained optimization methods. Student understands the basic of evolutionary optimization algorithms and can use them. Student can define and identify optimization problems. Student is able to summarize the role of optimization in process engineering.

Contents:

Mode of delivery:
Face-to-face teaching and exercises.

Learning activities and teaching methods:
The amount of guided teaching is 40 hrs. Contact teaching includes, depending on situation, lectures, group work and tutored group work. During self-study time student does independent or group work.

Target group:
M.Sc. students of process and environmental engineering and M.Sc. students interested in process optimization. Exchange and other international students.

Prerequisites and co-requisites:
No prerequisites but basic understanding on numerical methods and process modelling are useful.
Recommended optional programme components:
See prerequisites

Recommended or required reading:

Assessment methods and criteria:
This course uses continuous assessment that includes homework and classroom or home exams.

Grading:
The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Aki Sorsa

Working life cooperation:
No

477624S: Control System Methods, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: István Selek
Opintokohteen kielet: Finnish
Leikkaavuudet:
  477614S Control System Methods 3.0 op
  477605S Digital Control Theory 4.0 op

ECTS Credits:
5 ECTS / 135 hours of work

Language of instruction:
English

Timing:
Period 1 (autumn term)

Learning outcomes:
After completing the course, one understands the relevance and building blocks of model-based control design and system analysis. Relying on data-driven approaches, this course provides strong foundations for digital control design considering real-life applications.

Contents:
3. Laboratory exercises with the Valmet DNA automation system.

Mode of delivery:
Regular lectures

Learning activities and teaching methods:
Lectures and exercises including guided computer simulations

Target group:
M.Sc. students in process and environmental engineering
Prerequisites and co-requisites:
The courses 477621A Control system analysis and 477622A Control system design are recommended beforehand.

Recommended or required reading:
Lecture handout;
Dorf, R. (2010) Modern Control Systems. Prentice-Hall, New York, 1104 s,

Assessment methods and criteria:
Completion of homeworks and final (written) exam.

Grading:
Numerical grading scale 1-5 or fail.

Person responsible:
István Selek

Working life cooperation:
No
ETCS Credits:
5 ETCS / 135 hours of work

Language of instruction:
Lectures in Finnish. Lecture notes in English. Foreign students can participate by studying independently the material and by carrying out the exercise work and exam in English.

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course during the 4th year of studies.

Learning outcomes:
Ability to carry out structural analysis by using advanced numerical simulation technology. Knowledge of and ability to develop methods for verification of model data and accuracy of numerical solutions. Ability to present results of calculations in writing. Knowledge of different variational and energy principles of mechanics and ability to apply them in structural analysis. Knowledge of the properties of different structural models and ability to formulate an appropriate and validated mathematical model for specific problems. Knowledge of some special features concerning the analysis and dimensioning of steel, concrete and timber structures. Knowledge of special features of plate and shell structures from the viewpoint of structural design.

Contents:

Mode of delivery:
Face-to-face and independent study.

Learning activities and teaching methods:
Lectures and exercises 48 h, project work 24 h and independent work 63 h.

Target group:
Master level students in the study areas of structural engineering and engineering mechanics in the degree programs of civil and mechanical engineering, respectively.

Prerequisites and co-requisites:
Basic knowledge of statics, solid mechanics and differential & integral calculus.

Recommended optional programme components:
The course supports advanced courses in structural engineering and engineering mechanics.

Recommended or required reading:
Lecture notes and other electronic material.

Assessment methods and criteria:
The course is passed by partial exams during the course or by a final exam. A project work is also required.

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Senior research fellow Antti H. Niemi

Working life cooperation:
-

Other information:
-
Learning outcomes:
Upon completion of the course, the student will be able to design typical reinforced concrete structures to EN-standards.

Contents:
Strength and strain properties of concrete and reinforcing bars, time dependent properties. Limit state design of concrete beams and columns to EN standards. Service life design. Fire design. Anchoring and joints of reinforcing bars. Design of flanged cross sections, walls and wall like beams, and foundations carrying walls and columns.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 48 h, project work 24 h and independent work 63 h

Target group:
Bachelor level students in the degree program of civil engineering

Prerequisites and co-requisites:
Basic knowledge of statics, solid mechanics, concrete technology and structural engineering

Recommended or required reading:

Assessment methods and criteria:
The course is passed by partial exams during the course or by a final exam. A project work is also required.

Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Senior research fellow Antti H. Niemi

**Other information:**
This course will replace course 466107S Design of concrete structures in Academic year 2020-21.

485108A: Design of Steel Structures and Steel Construction, 5 op

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**
466105S Design of Steel Structures 6.0 op

**ECTS Credits:**
5 ects

**Language of instruction:**
Finnish

**Timing:**
Periods 1 and 2

**Learning outcomes:**
After completing the course the student is capable of explaining the crystalline structure of steel material and he understands elasto-plastic material model. He is able to explain the effect of inclusions, heat treatment and welding process to the mechanical properties of a steel material. The student is familiar with fire design of steel structures. He is able to explain common types of corrosion. The student is able to design the most typical joints in a steel frame and he can analyze simple steel structures. He is also able to analyze stability problems and explain the effects of imperfections and second order effects on frame behavior and member forces.

**Contents:**

**Mode of delivery:**
Face-to-face

**Learning activities and teaching methods:**
Lectures, exercises and self-study.

**Target group:**

**Prerequisites and co-requisites:**

**Recommended or required reading:**

**Assessment methods and criteria:**
Three midterm exams or one final exam is required. One design exercise is required.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Matti Kangaspuoaskari

Other information:
This course will replace course 466105S Design of Steel Structures in Academic year 2020-21.

485107A: Timber construction and product technology, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kiellet: Finnish

Traffic and road construction engineering

485401A: Basics of Traffic Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Virve Merisalo
Opintokohteen kiellet: Finnish
Leikkaavuudet:
488151A Basics of Traffic Engineering 5.0 op

ECTS Credits:
5 ECTS / 135 h of work

Language of instruction:
Finnish

Timing:
Period 1

Learning outcomes:
By completing the course the student knows the basics of modes of transport, the significance of traffic and transportation to society, traffic planning and research methods, transport economics and the external effects of transport.

Contents:
Modes of transport, Need for traffic and transportation, Transport planning and research, Economical and environmental impacts of traffic, Traffic safety.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h

Target group:
Students in the Bachelor’s Programme of Civil Engineering

Prerequisites and co-requisites:
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Materials delivered during the lectures

Assessment methods and criteria:
Examination and exercises

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Virve Merisalo

Working life cooperation:
-

Other information:
-

485402S: Advanced Course in Traffic Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Virve Merisalo
Opintokohteen kielet: Finnish

Leikkaavuudet:
488152S Advanced Course in Traffic Engineering 5.0 op

ECTS Credits:
5 ECTS / 135 h of work

Language of instruction:
Finnish

Timing:
Period 2

Learning outcomes:
By completing the course the student understands the basics of transport policy and the significance of transport economics to society. The student becomes familiar with traffic safety and is able to analyse the problems of traffic safety and opportunity to improve it.

Contents:
Transport policy, transport economics, traffic safety

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h

Target group:
Students in the Master's Programme of Civil Engineering

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Materials delivered during the lectures

Assessment methods and criteria:
Examination and exercises

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Virve Merisalo

Working life cooperation:
Yes

Other information:

485403A: Basics of Road Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Veikko Pekkala
Opintokohteen kielet: Finnish
Leikkaavuudet:
  488153A Basics of Road Engineering 5.0 op

ECTS Credits:
5 ECTS / 135 h of work

Language of instruction:
Finnish

Timing:
Period 3

Learning outcomes:
By completing the course student understands the basics of road design and construction, is able to calculate structure layers of road and is familiar with the maintenance of roads

Contents:
Road and street planning and design, lining, roads structure, maintenance of roads, basics of earthworks

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h

Target group:
Students in bachelor's programmes of environmental engineering

Prerequisites and co-requisites:
-

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
Materials delivered during the lectures

Assessment methods and criteria:
Exam, assignment and seminar work

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Veikko Pekkala

**Working life cooperation:**
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**Other information:**
-

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485404S: Road Design and Construction, 5 op

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Veikko Pekkala
**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS / 135 h of work

**Language of instruction:**
Finnish

**Timing:**
The course unit is held in the spring semester during period 4

**Learning outcomes:**
By completing the course student is familiar with road structure and function, structural modernisation, pavements and the basics of earthworks. He/she is also able to design road computer aided.

**Contents:**
Function of road structure, road damaging, structural modernisation, pavements, Road design and construction

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 28 h, exercises 32 h, self-study 75 h

**Target group:**
Students in the master's programmes of environmental engineering

**Prerequisites and co-requisites:**
485403A Basics of Road Engineering

**Recommended optional programme components:**
The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**
Materials delivered during the lectures

**Assessment methods and criteria:**
Exam and assignment(s)

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

A440256: Supplementary Module, Environmental Engineering, 20 - 30 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Enviromental Engineering A

488209S: Renewable Energy, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Huuhtanen, Mika Ensio
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 135 hours of work.
Language of instruction:
English
Timing:
Period 1

Learning outcomes:
The student is able to define different methods and techniques on renewable energy production field. The student can describe the energy production from renewable sources and is able to compare the environmental impacts of different ways of producing energy. He/she is able to identify main specific characters, challenges and driving forces in the field.

Contents:
Renewable energy production methods and technologies. Water and wind power, solar energy, biofuels, biomass conversion, side-streams utilization, power-to-X technologies, emissions and environmental aspects.

Mode of delivery:
Contact lectures

Learning activities and teaching methods:
Lectures 40h, self-study 95h

Target group:
Master’s degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
Course 488208A Energian tuotannon ja käytön perusteet is recommended.

Recommended optional programme components:
The course is pre-requisite for 488206S Sustainable Energy Project course.

Recommended or required reading:
Materials delivered via the Moodle environment.

Assessment methods and criteria:
Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Mika Huuhtanen

Working life cooperation:
No

Other information:
This course has replaced the course 488202S Production and Use of Energy.

488501S: Smart Grid I: Integrating renewable energy sources, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eva Pongracz
Opintokohteen kielet: English

ECTS Credits:
5 cr/150 hours of work

Language of instruction:
English

Timing:
Period 2

Learning outcomes:
The student is able to explain the concept of smart grids, the evolution of smart grids from electricity power grids, the information technology requirements as well as the economic,
environmental and social implications of smart grids. The student can explain the basic functioning of energy markets in Finland and the Nordic countries as well as the basics of electricity and carbon pricing. The student is also able to find real time data on variable energy sources (VRES) and able to apply the residual curve equation. The student can also explain the costs of large scale VRES integration and how they can be mitigated. The student can also explain demand site flexibility and the need for flexibility services emerging in the smart grid system. The student will know the expectations from smart grids and is able to outline the future perspectives of smart grid-based energy systems. The student is able to draft a scenario for the decarbonization of the energy system by 2050, and assess its economic, environmental and geopolitical implications, as well as the technological and infrastructural gaps.

Contents:
Multidisciplinary course, offered at the Faculty of Technology (Water, Energy and Environmental Engineering research group – WE3), in cooperation with Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC).

After an introductory presentation on the requirements, the background is set on the energy and environmental crisis, the co-evolution of energy and information systems and outlining the transition to a smarter system. Further, lectures on smart grids will be provided from an electrical engineering and information technology view on the evolution of electricity power grids, power generation transmission and distribution; distributed generation and futures of smart grids. From an environmental engineering point of view, lectures will be delivered on energy systems fundamentals, climate goals and decarbonization, as well as on the sustainability of smart grids will in particular the environmental and social impacts of smart grids. From economics points of view, lectures will be given on the liberalization and deregulation of the electricity market, electricity pricing, transmission and distribution as natural monopolies, smart grids and new market mechanisms, and the economic impacts of large-scale integration of renewable energy sources. Participation on lectures is not compulsory, but students are to answer to problem questions. As an exercise, students will be given a group work assignment that they are to work with throughout the duration of the course with the help of mentors. The subjects of the exercise is achieving climate goals and the future of energy systems.

Mode of delivery:
Implemented as face-to-face teaching and student seminar. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:
Lectures 32 h / student presentations 8 h, Guided group work: 8 h, individual homework 50 h/group work 37 h.

Target group:
Master's students of environmental engineering, especially of energy and environmental engineering orientation; Master's students in economics; Master's students of Electrical Engineering and Information Technology.

Prerequisites and co-requisites:
For Environmental Engineering students, admission to the Master's programme, for which minimally a former bachelor's degree is required. For other students the Bachelor level studies. A minimum of 10 ECTS worth of prior energy studies, bachelor level studies are acceptable. For example at Oulu: 488202S Production and use of energy, 488504S Fundamentals of nuclear energy.

Recommended or required reading:
Will be provided during the course by the lecturers.

Assessment methods and criteria:
Answering problem questions and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, participation in 50% of intermediate presentations and compulsory participation in the final presentation.

Grading:
The course evaluation will be based on an on-line learning portfolio and performance in the exercise participation and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

Other information:
The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488502S: Smart Grid II: Smart buildings/smart customers in the smart grid, 5 op

Voimassaolo: 28.11.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eva Pongracz
Opintokohteen kielet: English

ECTS Credits:
5 cr/137 hours of work

Language of instruction:
English

Timing:
Period 3

Learning outcomes:
The student is able to explain the concept of smart houses, and is able to demonstrate the optimization of smart house functions for energy efficiency, decarbonization and cost savings. Further, the student is familiar with the concepts and the technologies of smart house automation as well as other technologies used in smart houses such as smart appliances, smart metering and energy storage. The student will also understand the new role of consumers in the smart grid environment, their changing roles as well as current and future models of energy services. The student will also understand the risks of smart houses in terms of cyber security, data privacy and management. In addition, the student is able to outline the future perspectives of smart houses and smart consumers as part of the smart city framework and aiming toward eco-cities of the future.

Contents:
Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the course requirements, the basics are set in terms of defining smart houses as part of smart grids. Further the complementary roles of smart houses for energy efficiency, costs saving and decarbonization is explained. The key technologies of smart houses will be explained and demonstrated, including company presentations on existing commercial technologies and service models. In addition, the new role of consumers as prosumers and service users will be explained and demonstrated. There will be no exam, however, the students are to answer to problem questions related to the lectures and complete the exercises. There will be 4 exercises, concentrating on the 4 key themes of the course: smart house functions, smart house technologies, smart consumers, and energy services. Part of the exercises will be done as individual work that will be reported and some will be performed as group work. There will also be in-class guided exercises.

Mode of delivery:
Implemented as face-to-face teaching, visiting lectures and student presentations. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:
Lectures 28 h, student presentations 4 h, guided exercise work 24 h, individual work 45 h, group work 34 h.
Target group:
Master's students of environmental engineering, especially of energy systems orientation; Master's students in economics; Master's students of Electrical Engineering and Information Technology. Doctoral students are also welcome to participate.

**Prerequisites and co-requisites:**

Course 488501S Smart Grid I.

**Recommended or required reading:**

Will be provided during the course by the lecturers.


**Assessment methods and criteria:**

Answering problem questions, individual and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, compulsory participation in the in-course exercises and participation in the student presentation.

**Grading:**

The course evaluation will be based on an on-line learning portfolio, exercise performance and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

**Person responsible:**

Dr. Jean-Nicolas Louis
Other lecturers: Prof. Eva Pongrácz, Dr. Antonio Caló and Adeleye Adetunji.

**Other information:**

The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488503S: Smart Grid III: Smart energy networks, 5 op

**Voimassaolo:** 28.11.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuysikkö:** Field of Process and Environmental Engineering

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Eva Pongracz

**Opintokohteen kielet:** English

**ECTS Credits:**

5 cr/150 hours of work

**Language of instruction:**

English

**Timing:**

During period 4 in spring semester

**Learning outcomes:**

The student is able to explain the concept of energy transition, and is able to outline the structure and functioning of smart energy networks. Further, the student is familiar with the concepts of multiple energy networks, integrating multiple energy networks and networks flow analysis. The student will also understand the concept of swarms of distributed energy generation and the need for storage to ensure network stability. The student will also be able to outline the key energy storage methods and will be able to recommend them for distributed vs. centralized storage of both heat and electricity, for long term as well as short term. The student will also be able to use design tools for the planning and evaluation of future energy systems. The student will also be able to assess the dimensions of sustainability of smart energy networks.

**Contents:**

Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC).
After an introductory presentation on the course requirements, the basics are set in terms of defining energy transition to a carbon neutral energy future. Further the integration of multiple energy networks will be explained, as well as communication within multiple energy networks. The issue of swarms of distributed generation will be explained, as well as the economics of a system relying largely on renewables. The key storage technologies will be explained, demonstrating their use for heat or electricity storage, their effectiveness on small or large scale, as well as their purpose and economics of short and long term storage. Communication within the smart grid as well the economics of distributed generation in a future carbon neutral energy system will be explained. Finally, the sustainability assessment of smart energy network performance will be explained. There will be no exam, however, the students will need to answer to problem questions related to the lectures and complete exercises. There will be 3 exercises, concentrating on (1) evaluation of storage technologies, (2) simulation of future smart energy networks and (3) sustainability assessment. The simulation work will be done as group work using the EnergyPlan freeware, for which in-class guidance will be provided. The results of the simulation will have to be presented. The rest will be done as individual work.

**Mode of delivery:**
Implemented as face-to-face teaching, visiting lectures and student presentations. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

**Learning activities and teaching methods:**
Lectures 28 h, student presentations 4 h, guided exercise work 24 h, individual work 50 h, group work 38 h.

**Target group:**
Master’s students of environmental engineering, especially of energy and environmental engineering orientation; Master’s students in economics; Master’s students of Electrical Engineering and Information Technology. Doctoral students are also welcome to participate.

**Prerequisites and co-requisites:**
Completing Smart grids 1 is a prerequisite, completing Smart grids 2 prior to this course is also recommended.

**Recommended or required reading:**

**Assessment methods and criteria:**
Answering problem questions, individual and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, compulsory participation in the in-course exercises and participation in the student presentation.

**Grading:**
The course evaluation will be based on an on-line learning portfolio, exercise performance and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

**Person responsible:**
Prof. Eva Pongrácz (EEE) and Prof. Maria Kopsakangas-Savalainen (OBS). Other lecturers: EEE: Dr. Antonio Caló, Dr. Jean-Nicolas Louis; OBS: Enni Ruokamo; CWC: Dr. Jussi Haapola, MSc. Florian Kühlenz

**Other information:**
The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

*Environmental engineering B*

**477309S: Process and Environmental Catalysis, 5 op**

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettaja: Satu Pitkäaho
Opintokohteen kielet: English
Leikkaavuudet:
470226S Catalytic Processes 5.0 op

ECTS Credits:
5 ECTS / 133 hours of work

Language of instruction:
English

Timing:
Implementation in autumn semester, during 1st period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:
Student recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes, energy production, and environmental engineering. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, and the importance of catalyst research.

Contents:

Mode of delivery:
Lectures including design exercises, face-to-face teaching.

Learning activities and teaching methods:
Lectures 20 h, exercises 10 h, teamwork presentations 20 h, portfolio work 40 h and self-study 60 h.

Target group:
Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
488212A Katalyysin perusteet or 488309A Biokatalyysi

Recommended or required reading:
-

Assessment methods and criteria:
Portfolio and written examination

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Satu Pitkäaho and Esa Turpeinen

Working life cooperation:
No

488203S: Industrial Ecology, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Väisänen, Virpi Maria
Opintokohteen kielet: English
Leikkaavuudet:
ay488203S Industrial Ecology and Recycling 5.0 op
480370S Industrial Ecology and Recycling 5.0 op
ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
English

Timing:
Implementation in autumn semester during 1st period.

Learning outcomes:
Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

Contents:
Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

Mode of delivery:
Face-to-face teaching in English.

Learning activities and teaching methods:
Lectures 30 h / Group work 30 h / Self-study 75 h. The exercises are completed as guided group work.

Target group:
Master's degree students of process and environmental engineering.

Recommended or required reading:

Assessment methods and criteria:
All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.

Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University teacher Virpi Väisänen

Working life cooperation:
No

488214S: Air Pollution Control Engineering - Practical Solutions, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Satu Pitkäaho
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
English

Timing:
Implementation in autumn semester during 2nd period first time in Autumn term 2020.

Learning outcomes:
Student is able to explain what kind of air emissions originate from different industrial and energy production sectors. Student deepens knowledge obtained in 488213A course and is able to apply it to different practical emission problems. She/he is able to comprehensively describe, choose, design and optimize emission control technologies. Student understands essential regulations and laws concerning emission control.

Contents:
Principles of air pollution control equipment and their use in real applications. Emission control case studies in industry and energy production sector. Air pollution related regulations and laws.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 30 h, exercises 12 h, homework 8 h, teamwork presentations 10 h, and self-study 75.

Target group:
Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
488213A Ilmansuojelutekniikan perusteet

Recommended or required reading:
Materials in the Optima environment. de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 pp

Assessment methods and criteria:
Written final exam or intermediate exams.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Satu Pitkäaho ja Esa Turpeinen

Working life cooperation:
No

Other information:
Replaces the course 488204S Air Pollution Control Engineering.

488215S: Industry and Environment, 5 op

Voimassaolo: 28.06.2019
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Sanna Päiväranta-Antikainen, Väisänen, Virpi Maria
Opintokohteen kiele: English
Leikkaavuudet:
5.0 op

**Industry and Environment (OPEN UNI)**

**Environmental Load of Industry**

**Environmental Load of Process Industry**

**ECTS Credits:**
5 cr / 135 hours of work

**Language of instruction:**
English

**Timing:**
This course will teach first time in Autumn 2020, period 2.
This course replaces course 488221S Environmental Load of Industry.

**Learning outcomes:**
The student is able to identify the essential features of the environmental load in different types of (chemical, wood, metallurgical, ...) industry. He/she is able to explain the type, quality, quantity and sources of the emissions. The student is familiarized with the main emission control systems and techniques in different industrial sectors. The student can explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

**Contents:**
Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.

**Mode of delivery:**
Face-to-face teaching.

**Learning activities and teaching methods:**
Lectures 40 h, self-study 93h.

**Target group:**
Master’s degree students of the Process and Environmental Engineering study programmes.

**Prerequisites and co-requisites:**
The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II, 488204S Air Pollution Control Engineering and 488110S Water and Wastewater Treatment recommended beforehand.

**Recommended or required reading:**
Material represented in lectures and in the Optima environment.

**Assessment methods and criteria:**
Written final exam or a learning diary.
Read more about the course assessment and grading systems of the University of Oulu at [https://www.oulu.fi/forstudents/assesment-criteria](https://www.oulu.fi/forstudents/assesment-criteria)

**Grading:**
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

**Person responsible:**
Virpi Väisänen

**Working life cooperation:**
No.

**Other information:**
The course mainly consists of specific lectures presented by experts who are invited from industry.

This course will teach as online course in Fitech in Spring Term 2020.

*Environmental engineering C*

**488110S: Water and Wastewater Treatment, 5 op**
Learning outcomes:
Upon completion of the course, the student will be able to understand the theory and practicalities behind the most used purification processes in water and wastewater treatment. The student will also be capable of performing basic dimensioning calculations and therefore he/she will be able to dimension structures /units of water and wastewater treatment plants and to comprehend the basic requirements of different purification processes.

Contents:
Water quality characteristics of source water; basic principles of purification processes (coagulation /flocculation, sedimentation, biological treatment, filtration, disinfection, etc); process units in water and wastewater treatment; selection of process units; dimensioning of treatment structures and unit processes.

Mode of delivery:
Mix of guided self-study work, face-to-face teaching and field visits.

Target group:
Students in master program of environmental and civil engineering.

Prerequisites and co-requisites:
The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering (477013P) or I (477011P) and II (488010P).

Recommended or required reading:

Assessment methods and criteria:
The course can be completed in two different study modes: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) Passive mode (book exam): 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material. (Passive mode can be complete under special circumstances).

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Read more about assessment criteria at the University of Oulu webpage.
Person responsible:
Post-doctoral researcher Dr Elisangela Heiderscheidt

Working life cooperation:
Through visits to water and wastewater treatment plants, which include lectures provided by environmental engineers in charge and guided tours, the students familiarize with the main technological and process related principles of the field and have the chance to experience in firsthand how to deal with some of the most common issues related to water and wastewater purification systems.

Other information:
The course will be held as distance learning in the fall of 2020.

488134S: Hydrogeology and groundwater engineering, 5 op

Voimassaalo: 28.11.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Pekka Rossi
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/133 hours of work

Language of instruction:
English

Timing:
The course unit is held in the spring semester, during period 3

Learning outcomes:
Upon completion of the course, the student will have knowledge on groundwater systems and the basic hydrogeological and engineering concepts involved. This includes analysis of flow in porous media, hydraulics of groundwater systems, groundwater quality and groundwater use. After the course students are able to estimate key factors influencing on groundwater recharge, flow and discharge and to use general methods to calculate groundwater flow.

Contents:
2D and 3D groundwater flow, conceptual models, unsaturated layer flow, water storage and retention, heterogeneity and isotropy, aquifer types, pumping tests, geophysical methods, groundwater quality and resources in Finland.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
lectures (18 h), calculus lectures (12 h), homework, exercises and self-study (103 h).

Target group:
Master students in the water engineering orientation of the Environmental Engineering program and in master program of civil engineering.

Prerequisites and co-requisites:
The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes.

Recommended or required reading:
Lecture handouts
Assessment methods and criteria: 
exam and/or lecture exams.

Grading: 
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible: 
Postdoctoral Researcher Pekka Rossi

Working life cooperation: 
Students familiarize themselves to a real groundwater aquifer cases discussed in lectures and in the course exercise.

488135S: Water distribution and sewage networks, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Pekka Rossi
Opintokohteen kielet: English
Leikkaavuudet: 488144A Water distribution and sewage networks 5.0 op

ECTS Credits: 
5 ECTS credits/133 hours of work

Language of instruction: 
English

Timing: 
The course unit is held in the autumn semester, in period 2

Learning outcomes: 
Student knows and understands the systems and dynamics needed for water distribution and waste water networks. Student is able to do basic dimensioning for water distribution network and sewer system of an urban area.

Contents: 
Water distribution and waste water network design and dimensioning, Pumping and storage tanks needed in distribution of water and collection of sewage waters, renovation of pipelines, special circumstances in water distribution, effects of cold climate and harmful hydraulic conditions.

Mode of delivery: 
Face-to-face teaching

Learning activities and teaching methods: 
Lectures (30 h), homework (45 h) and a design exercise (58 h).

Target group: 
Students in master program of environmental engineering and in master program of civil engineering

Prerequisites and co-requisites: 
Use of AutoCAD-program

Recommended optional programme components: 
The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Virtaustekniikka, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and
Recommended or required reading:
Lecture handout and other materials delivered in lectures. To the appropriate extent: RIL 237-1-2010 Vesihuoltoverkkojen suunnittelu, RIL 237-2-2010 Vesihuoltoverkkojen suunnittel, RIL 124-2 Vesihuolto II, Mays Water distribution systems handbook

Assessment methods and criteria:
Exam and a design exercise.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Postdoctoral Researcher Pekka Rossi

Working life cooperation:
Visit to a site of water distribution network building site, pumping station or water supply/sewerage company.

488206S: Sustainable Energy Project, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Huuhtanen, Mika Ensio
Opintokohteen kielet: English
Leikkaavuudet:
488410A Introduction to Sustainable Energy 10.0 op

ECTS Credits:
5 ECTS / 135 hours of work

Language of instruction:
English

Timing:
Implementation in periods 1 and 2.

Learning outcomes:
The student is able to adapt the (skills) tools learned in previous courses to complete an energy production and management design project. The student will solve an engineering problem related to sustainable energy generation in cold climate. The student is able to describe the key practical issues related to sustainable energy generation. The student will evaluate the relevant instruments, tools and measures required for sustainable energy production, distribution, and end-use efficiency. The student will demonstrate the ability to select the proper tools, and methods to solve the design problem. The student will also acquire skills to work as a member in an engineering design project as part of a team. He/she will gain the experience to carry out a real project and produce a documentation of the engineering solution.

Contents:
A design project to adapt small-scale renewable energy production and management, greenhouse gas reduction and/or utilization, wind, solar, and geothermal energy generation. Management of energy efficiency. Energy engineering and design principles. Performance evaluation and sustainability assessment of the selected project. Problem solving.

Mode of delivery:
Team work, group meetings and seminars

Learning activities and teaching methods:
Lectures (6 h), guided project design in small groups (30 h), individual and group work (80 h) presentations and reporting (20 h).
Target group:
Master’s degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:
The course 488209S Renewable Energy is a compulsory. The 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project.

Recommended or required reading:
Materials delivered on lectures and during the group meetings. Additional literature: Manuals and databases, depends on the project work selected.

Assessment methods and criteria:
Written report with the documentation of the engineering solution and seminar. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
University lecturer Mika Huuhtanen

Working life cooperation:
No

555305M: Advanced Studies in other Universities /Institutes, 0 - 30 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Person responsible:
University lecturer Osmo Kauppila

555306M: Elective Studies in other Universities /Institutes, 0 - 30 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

Person responsible:
University lecturer Osmo Kauppila

A440269: Special Module, 0 - 10 op
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Special Module
International students should select 555212P, 030008P and 900017Y

**555212P: Orientation Course for New Students, 1 op**

- **Voimassaolo:** 01.08.2013 -
- **Opiskelumuoto:** Basic Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Industrial Engineering and Management
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Osmo Kauppila
- **Opintokohteen kielet:** Finnish
- **Leikkaavuuudet:**
  - 555203P Study Skills 2.0 op

**Person responsible:**
University lecturer Osmo Kauppila

**030005P: Information Skills, 1 op**

- **Opiskelumuoto:** Basic Studies
- **Laji:** Course
- **Vastuuysikkö:** Faculty of Technology
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Ursula Heinikoski
- **Opintokohteen kielet:** Finnish
- **Leikkaavuuudet:**
  - 030004P Introduction to Information Retrieval 0.0 op

**ECTS Credits:**
1 ECTS credit / 27 hours of work

**Language of instruction:**
Finnish

**Timing:**
Architecture 3. spring semester, period III;
biochemistry 3. autumn semester;
biology 3. autumn semester, period I;
chemistry 3. autumn semester, period I;
civil engineering 2. spring semester, period IV;
computer science and engineering 2. spring semester, period IV;
electronics and communications engineering 3. spring semester;
geosciences 2. spring semester, period IV;
geography 3. semester, periods I and III;
industrial engineering and management 3. year;
information processing sciences 1. or 3. year;
mathematics and physics 1. spring semester, period III;
mechanical engineering 3. year;
mining engineering and mineral processing 3. year;
process and environmental engineering 2. year, period II;
Master's degree students in industrial engineering and management 1st year.

Learning outcomes:
Upon completion of the course, the students:
- can search scientific information,
- can use the most important databases of their discipline,
- know how to evaluate search results and information sources,
- can use the reference management tool.

Contents:
Scientific information retrieval process, the most important databases and publication channels of the discipline, evaluation of the reliability of information sources and reference management tool.

Mode of delivery:
Blended teaching: classroom training, web-based learning material and exercises, a group assignment.

Learning activities and teaching methods:
Training sessions 8 h, group working 7 h, self-study 12 h

Target group:
Compulsory for all bachelor degree students of Faculty of information technology and electrical engineering, Faculty of Technology and Faculty of science. Compulsory also for those Master’s degree students in Industrial Engineering and Management who have no earlier studies in the information skills. Optional for the students of biochemistry.

Recommended optional programme components:
In biochemistry the course is completed as a part of 740376A Bachelor's Thesis.

Recommended or required reading:
Web learning material Tieteellisen tiedonhankinnan opas

Assessment methods and criteria:
Passing the course requires participation in the training sessions and successful completion of the course assignments.

Grading:
pass/fail

Person responsible:
Ursula Heinikoski

030008P: Information Skills for foreign degree students, 1 op

Voimassaalo: 01.08.2012 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Faculty of Technology
Arvostelu: 1 - 5, pass, fail
Opettajat: Klintrup, Outi-Mirjami
Opintokohteen kielet: English

ECTS Credits:
1 ECTS credits / 27 hours of work

Language of instruction:
English

Timing:
1st year of Master's Degree Programme in Environmental Engineering (BEE) and in Industrial Engineering and Management (international students). The course is held in the autumn semester, during period II and in the spring semester, during period IV.

Learning outcomes:
Upon completion of the course, the students:
- can search scientific information for their thesis,
- know how to evaluate search results and information sources,
- understand the principles of scientific publishing,
- can use a reference management tool.

Contents:
Scientific information retrieval and the search terms, the most important databases and publication channels of the discipline, tools for evaluating the quality of scientific information and reference management.

Mode of delivery:
Blended teaching

Learning activities and teaching methods:
Training sessions 8 h, group work 7 h, self-study 12 h

Target group:
The course is compulsory for the Master’s Degree Programme in Environmental Engineering (BEE) and for the Master’s Degree Programme in Industrial Engineering and Management (international students). Optional for other degree students working on their diploma/master’s thesis.

Recommended or required reading:
Web learning material: "Finding scientific information"

Assessment methods and criteria:
Passing the course requires successful completion of the course assignments.

Grading:
Pass/fail

Person responsible:
Outi Klintrup

900017Y: Survival Finnish, 2 op

Voimassaolo: 01.08.1995 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuysikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay900017Y Survival Finnish Course (OPEN UNI) 2.0 op

Proficiency level:
A1.1

Status:
The course is intended for the international students in every faculty at the University of Oulu.

Required proficiency level:
No previous Finnish studies.

ECTS Credits:
2 ECTS cr

Language of instruction:
Finnish and English.

Timing:
-

Learning outcomes:
By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.
Contents:
This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the 'where'-question.

Mode of delivery:
Contact teaching, on-line learning and independent work. There will be organized also one on-line group in each semester.

Learning activities and teaching methods:
Lessons 2 times a week (26 h, including the final exam) and guided self study (24 h).

Target group:
International degree and post-graduate degree students, exchange students and the staff members of the University.

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:
Will be provided during the course.

Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Grading scale is on a pass/fail basis.

Person responsible:
Arja Haapakoski

Working life cooperation:
-

Other information:
Sign-up in WebOodi or in Tuudo.

Recommended studies

555214A: Working in the university community, 5 op

Voimassaolo: 01.01.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits

Language of instruction:
Finnish / English

Timing:
Periods 1-4

Learning outcomes:
Upon completion of the course, the student will be able to:
- apply the skills required for the tasks in the university community (communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills)
- take responsibility for the tasks in a responsible manner
- analyse and find development targets related to the tasks

Contents:
Communication, collaboration, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills.

Mode of delivery:
The tuition will not be organised.

Learning activities and teaching methods:
Students complete tasks with their own activities to support the university community and their own professional growth.

Target group:
Industrial Engineering and Management students.

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management or similar knowledge.

Recommended optional programme components:
-

Recommended or required reading:
-

Assessment methods and criteria:
The course can include several tasks as follows: Student Union 2 years 2 ECTS, University Board 1 year 2 ECTS, University Collegial Body 2 years 2 ECTS, Education Council 1 year 2 ECTS, Education Management Team 1 year 2 years, Faculty Management Team 1 year 2 ECTS, Faculty Board 2 years 2 ECTS, Faculty Education Council 2 years 2op, Student Union Board 1 year 1-3 ECTS, National Student Organisation 1 year 1-5 ECTS, Other major education policy and / or teaching development tasks 1-3 ECTS credits, Student Tutor or Teaching Assistant 2 ECTS cr.
The student writes a report on conducting the tasks, which includes the following: 1) In which positions did the student work, how long and how actively he/she participated? (0.5 pages). 2) What does the student think he/she has learned from the duties and how can the experience be utilized in the future? In particular, these skills should be considered: communication, co-operation, creativity, problem-solving, project management, learning, technical skills, international skills, commercial and financial skills and the development of self-knowledge (1 page). 3) How would the student think that the activity could be developed by the methods of industrial engineering and management? (1.5 pages). A report and a certificate on the tasks will be returned to the teacher tutor, who determines the number of credits to be awarded. The length of the report is 3 pages.

Grading:
pass / fail

Person responsible:
University lecturer Osmo Kauppila

Working life cooperation:
-

Other information:
-
555215A: Working life project, 5 op

Voimassaolo: 01.01.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits

Language of instruction:
Finnish / English

Timing:
Periods 1-4

Learning outcomes:
Upon completion of the course, the student will be able to:

- apply the skills required for the tasks in the working life (communication, co-operation, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills)
- take responsibility for the project in a responsible manner
- analyse and find development targets related to the project

Contents:
Communication, collaboration, creativity, problem solving, project management, learning, technical skills, international skills, commercial and financial skills.

Mode of delivery:
The tuition will not be organised.

Learning activities and teaching methods:
Students complete tasks with their own activities to support their own professional growth.

Target group:
Industrial Engineering and Management students

Prerequisites and co-requisites:
555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management or similar knowledge.

Recommended optional programme components:
-

Recommended or required reading:
-

Assessment methods and criteria:
Participation in a project, competition or similar organized by the academic community, and with a linkage to business life (e.g. Accenture innovation challenge, ESTIEM Times).

The student writes a report on participation in the project, consisting of:
1) In which project did the student work, when and what was the project scope? (0.5 pages).
2) What does the student think he/she has learned from the duties and how can the experience be utilized in the future? In particular, these skills should be considered: communication, co-operation, creativity, problem-solving, project management, learning, technical skills, international skills, commercial and financial skills and the development of self-knowledge (1 page).
3) How did the project succeed and how the project could be developed using IEM methods? (1.5 pages).
A report and a certificate of project completion will be returned to the teacher tutor, who determines the number of credits to be awarded.

**Grading:**
pass / fail

**Person responsible:**
University lecturer Osmo Kauppila

**Working life cooperation:**
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**Other information:**
-

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**555300S: Master's Thesis, 30 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuysikkö:** Field of Industrial Engineering and Management

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Osmo Kauppila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
470099S Master's Thesis in Industrial Engineering and Management 30.0 op

**ECTS Credits:**
30 ECTS credits.

**Language of instruction:**
Finnish / English.

**Timing:**
Periods 1-4.

**Learning outcomes:**
Upon completion of the course, the student will be able to:
- solve challenging problems in organisations independently
- create a research plan, and define a research problem and research questions
- manage his own work according to the research plan
- utilise different information sources and critically evaluate the information obtained
- create a written report according to the instructions

**Contents:**
The research topic is selected in co-operation with the instructor.

**Mode of delivery:**
The tuition will be implemented as self-study and face-to-face teaching.

**Learning activities and teaching methods:**
Self-study 804 h. The student defines the research topic in co-operation with the instructor. The thesis is typically an empirical or a theoretical study.

**Target group:**
Industrial Engineering and Management students.

**Prerequisites and co-requisites:**
B.Sc. in Industrial Engineering and Management or equivalent. Courses that support the topic of the thesis.

**Recommended optional programme components:**
The students will complete 555301S Research seminar in industrial engineering and management simultaneously.

**Recommended or required reading:**
The instructions and forms related to master’s thesis are available at Oulu University's [Master's thesis webpage](#).

**Assessment methods and criteria:**
This course includes writing a Master’s Thesis. The work is assessed by using the [thesis assessment form](#).

**Grading:**
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
University lecturer Osmo Kauppila

**Working life cooperation:**
-
The thesis is typically done for a private or public sector organisation.

Other information:
The general instructions related to thesis, matury test and graduation are available at the Oulu University's webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.
Substitutes course 477991S Master's Thesis.

555302S: Maturity Test / Master of Science in Industrial Engineering and Management, 0 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:
555312S Maturity Test / Industrial Engineering and Management 0.0 op

Assessment methods and criteria:
Maturity test related to the thesis topic is taken as an electronic exam in the Exam-system. Examination time is settled with the thesis supervisor. The assessor of the maturity test (supervisor) creates the maturity into the Exam system as a personal exam.

Grading:
Pass - Fail

Person responsible:
University lecturer Osmo Kauppila

Other information:
The general instructions related to thesis, matury test and graduation are available at the Oulu University's webpage "Thesis and graduation". Check the instructions for Industrial Engineering and Management Programme at "For you" - menu.

Tutkintorakenteisiin kuulumattomien opintokonaisuuksien ja -jaksojen kuvaukset

902142Y: Business Correspondence, 2 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuysikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

Proficiency level:
CEFR B2 - C1 (All Levels)

Status:
This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

Required proficiency level:
English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.

ECTS Credits:
2 credits. The workload is 53 hours

**Language of instruction:**
English

**Timing:**
The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters. Check the study guide for availability in your department.

**Learning outcomes:**
By the end of the course, you are expected to have demonstrated:
- the ability to write clear and effective business letters conveying information and details accurately,
- the ability to use an appropriate level of formality and style for business communications,
- mastery of the conventional formats and layouts of different types of business letters.

**Contents:**
The aim of this course is to introduce different types of business correspondence and the format used when communicating in writing. Types of correspondence include communication in business-to-business scenarios and between a business and the public.

**Mode of delivery:**
Self-access: the course operates within an online workspace, with online support from the teacher.

**Learning activities and teaching methods:**
Introductory session 2 hours / independent learning 51 hrs / optional text clinics. Assignments, instructions and course resources are available in the online course workspace. Completed assignments are submitted electronically to the teacher. The teacher provides feedback and any problems are discussed either by written electronic communication or at one of the optional text clinics.

**Target group:**
Students in the engineering programmes (TTK and TST)

**Prerequisites and co-requisites:**

**Recommended optional programme components:**
This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK and TST).

**Recommended or required reading:**
Course materials are provided in an electronic form that can be downloaded.

**Assessment methods and criteria:**
All assignments must be completed to a standard of effective business correspondence based on the learning outcomes of the course. In addition, there is a test at the end of the course.

Lue lisää [opintosuoritusten arvostelusta](yliopiston verkkosivulta).

**Grading:**
Pass/Fail

**Person responsible:**
Susan McAnsh

**Working life cooperation:**

**Other information:**

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**902143Y: Company Presentations, 2 op**

**Voimassaolo:** 01.08.2014 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuysikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**Proficiency level:**
[CEFR B2-C1](Average - Advanced)

**Status:**
This course is part of the compulsory foreign language studies in English for students in the Industrial Engineering and Management (TuTa) programme.

**Required proficiency level:**
English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.

**ECTS Credits:**
2 credits. The workload is 53 hours.

**Language of instruction:**
English

**Timing:**
The course is held in the autumn semester, during periods I and II.

**Learning outcomes:**
By the end of the course, students are expected to be able to:
- use principles of good presentation structuring for optimal clarity,
- establish and maintain audience rapport in the presentation setting,
- use principles of good slideshow design,
- present a company plan for sales and operations in English effectively, using appropriate style and vocabulary,
- use observation of self and others to continue developing and fine-tuning presentation skills.

**Contents:**
The aim of the course is to help students at all levels to better conceptualise what constitutes a good presentation, and to develop their confidence in giving presentations and interacting with an audience in a business context.

The early weeks of the course focus on development of vocabulary related to operations planning and oral activities in small groups. Students learn about key concepts in giving presentations, such as openings and closings, organisation of content, clear articulation, use of visual aids, and audience interaction.

In the second half of the course, teams of students plan, prepare and rehearse a company presentation on the Sales and Operations plan for a particular company. These activities lead to a team presentation in front of an audience.

**Mode of delivery:**
Contact teaching and independent study

**Learning activities and teaching methods:**
Lessons 24 hours / Independent work 29 hours.

**Target group:**
2nd year students of Industrial Engineering and Management

**Prerequisites and co-requisites:**
555225P Basics of Industrial Engineering and Management or similar knowledge.

**Recommended optional programme components:**
Students will simultaneously complete the 555226A Operations and Supply Chain Management course.

**Recommended or required reading:**
Course materials will be provided by the teacher in electronic form, to be downloaded and brought to class.

**Assessment methods and criteria:**
The course utilises continuous assessment that is based on the learning outcomes of the course. In addition, full and active participation is required. Course assignments must be completed. Students must pass an online vocabulary test and give a presentation as part of a team demonstrating the skills specified in the learning outcomes.

**Grading:**
Pass / fail.

**Person responsible:**
Suzy McAnsh

**Working life cooperation:**
-

**Other information:**
-

**555310S: Demola Project, 5 op**

Voimassaolo: 01.01.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
902150Y: Professional English for Technology, 2 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English
Leikkaavuudet:

Proficiency level:
CEFR B2 - C1
Status:
This course is the first English course for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).
Required proficiency level:
English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise.
If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.
ECTS Credits:
2 credits. The workload is 53 hours.
Language of instruction:
English
Timing:
The course takes place in the autumn semester (periods 1 and 2).
Learning outcomes:
By the end of the course, you can
- create and deliver effective presentations of a product, a company and company processes,
- apply appropriate cultural, linguistic and technical knowledge when presenting a product or company,
- evaluate your own strengths and weaknesses in English-language communication, with a view to developing appropriate skills in future.

Contents:
Scheduled as the first course of your English studies, Professional English for Technology (PET) has a strong focus on developing speaking skills necessary for working life. During PET, you will explore a product or service from your own field, and give a variety of short presentations in connection with your product or service. In addition, PET helps you to develop an awareness of your own language skills, encouraging you to develop strategies and techniques for effective learning.
Mode of delivery:
Contact teaching and independent study
Learning activities and teaching methods:
Lessons 24 hours / independent work 29 hours. Lessons include regular pair and group work in class.
Independent homework activities include team work for the preparation of four short presentations, vocabulary study and other small assignments. Active participation is essential.
Target group:
Students in the engineering programmes: TTK (PO1, YMP1, KO1, TuTa1, RaKy), TST (ST2, CSE2).
Prerequisites and co-requisites:

Recommended optional programme components:
This course is offered as the first course of your English studies.
Recommended or required reading:
Course materials will be provided by the teacher in electronic form.
Assessment methods and criteria:
The course utilises continuous assessment that is based on the learning outcomes of the course, including full and active participation in class, and the successful completion of module assignments and class presentations.
Lue lisää [opintosuoritusten arvostelusta](#) yliopiston verkkosivulta.
Grading:
pass / fail

Person responsible:
Each engineering programme has its own Languages and Communication contact teacher for questions about English studies.

Working life cooperation:
-

Other information:
-

902145Y: Working Life Skills, 2 op

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:
CEFR B2 - C1
(Alla levels)

Status:
This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

Required proficiency level:
English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication teachers for your department to discuss individual solutions.

ECTS Credits:
2 ECTS credits. The workload is 53 hours.

Language of instruction:
English

Timing:
The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters. Check the study guide for availability in your department.

Learning outcomes:
By the end of the course, you are expected to
1. have demonstrated a good basic vocabulary related to job applications, meetings and negotiations,
2. have demonstrated an ability to create an effective CV and cover letter for a job application,
3. be able to communicate effectively and with a reasonable degree of fluency at job interviews and in meeting and negotiation contexts.

Contents:
The aim of this course is to help you to develop the English language skills needed to deal with situations related to everyday working life. The course focuses on four basic areas:

i) business communication
ii) social and cultural aspects of English in working life situations,
iii) applying for a job,
iv) a general introduction to the language of meetings and negotiations.

Mode of delivery:
Contact teaching and independent study

Learning activities and teaching methods:
Lessons 26 hours / independent work 27 hours. Active participation is essential. The course includes regular pair and group work in class and independent homework activities.

Target group:
Students in the engineering programmes (TTK and TST).

Prerequisites and co-requisites:
-

Recommended optional programme components:
This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK and TST).

**Recommended or required reading:**
Course materials will be provided by the teacher in electronic form.

**Assessment methods and criteria:**
The course utilises continuous assessment that is based on the learning outcomes of the course. In addition, full and active participation is required, course assignments must be completed, and students must achieve a grade of 70% in two tests during the course. Students will be asked to take an end-of course exam if they have not otherwise demonstrated that they have achieved the learning outcomes by the end of the course. Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
Pass/fail

**Person responsible:**
Susan McAnsh

**Working life cooperation:**
-

**Other information:**

See contact teachers, [https://www.oulu.fi/kielikoulutus/node/56574](https://www.oulu.fi/kielikoulutus/node/56574).