Opasraportti

ITEE - Computer Science and Engineering DP (2017 - 2018)

Degree Programme in Computer Science and Engineering

Programme Structure Diagram of Degree Programme in Computer Science and Engineering is here: Bachelor of Science (Technology) and Master of Science (Technology). Programme Director of Degree Programme is Janne Heikkilä.

Programme Structure Diagram of Master's Programme in Computer Science and Engineering (2 year) is here.

International Master's Programme in Computer Science and Engineering, Programme Structure Diagram is here.

Study Advising

In the Degree Programme in Computer Science and Engineering: study.itee(at)oulu.fi

Tutor Teachers and Student Tutors

Everyone new student is appointed tutor teacher and student tutor in Univeristy of Oulu. Tutor Teachers of Degree Programme in Computer Science and Engineering and student tutors is here.

University of Oulu

Information and Communication Technologies (ICTs)

Degree Programme in Computer Science and Engineering 2017-2018

Bachelor of Science (Technology)

Course Structure Diagram 2017-2018

Year/Term1st autumn1st spring2nd autumn2nd spring3rd autumn3rd spring

CodeTitleECTS123412341234

Compulsory Basic Studies, 59 ECTS cr

521002P	Orientation to Computer Science	5.0	2.5	2.5

	and Engineering													
031010P	Calculus I	5.0	5.0											
031078P	Matrix Algebra	5.0		5.0										
521141P	Elementary Programming	5.0	2.5	2.5										
901048Y	Second Official Language (Swedish), Written Skills	1.0			1.0									
901049Y	Second Official Language (Swedish), Oral Skills	1.0			1.0									
900081Y	Second Official Language (Finnish), Written Skills	2.0												
900082Y	Second Official Language (Finnish), Oral Skills	3.0												
031075P	Calculus II	5.0			5.0									
031021P	Probability and Mathematical Statistics	5.0			5.0									
902011P	Technical English 3	6.0					1.0	1.0	1.0	1.0	1.0	1.0		
031023P	Mathematical Structures for Computer Science	5.0					5.0							
031077P	Complex analysis	5.0					5.0							
030005P	Information Skills	1.0								1.0				
031076P	Differential Equations	5.0				5.0								
761113P	Electricity and magnetism	5.0							5.0					
521159P	Principles of Digital Fabrication	5.0				5.0								
521160P	Introduction to Artificial Intelligence	5.0						5.0						
Compulsory Intermediate Studies, 71 ECTS cr														
521109A	Electrical Measurement Principles	5.0	5.0											
521301A	Digital Techniques 1	8.0			4.0	4.0								
521150A	Introduction to Internet	5.0								5.0				
521286A	Computer Systems	8.0					4.0	4.0						
521457A	Software Engineering	5.0							5.0					
521145A	Human-Computer Interaction	5.0		5.0										
811312A	Data Structures and Algorithms	5.0						5.0						
031080A	Signal Alalysis	5.0						5.0						
521453A	Operating Systems	5.0								5.0				
521495A	Artificial Intelligence	5.0										5.0		
521467A	Digital Image Processing	5.0									5.0			
Bachelorâ€™s Thesis, 10 ECTS cr														
523991A	Bachelor's Thesis / Information Engineering	8.0											4.0	4.0

900060A	Technical Communication	2.0	1.0	1.0				
Preparatory Module for the Orientation 15 ECTS cr (only one module is selected)								
1. Information Processing Engineering:								
031022P	Numerical Analysis	5.0					5.0	
521337A	Digital Filters	5.0						5.0
521330A	Telecommunication Engineering	5.0						5.0
2. Applied Computing:								
521151A	Applied Computing Project I	10.0			5.0		5.0	
521157A	Introduction to Social Network Analysis	5.0						5.0
3. Embedded Systems:								
521302A	Circuit Theory 1	5.0				5.0		
521431A	Principles of Electronics Design	5.0					5.0	
521337A	Digital Filters	5.0						5.0
Supplementary Modules 15 ECTS cr								
	Change Sublementary Studies 15 ECTS cr	15.0			5.0	5.0	5.0	
Optional Studies 10 ECTS cr: 1. Information Processing Engineering								
	Change Optional Sudies 10 ECTS cr	10.0			8.0		2.0	
Optional Studies 10 ECTS cr: 3. Applied Computing								
	Change Optional Sudies 10 ECTS cr	10.0			3.0		7.0	
Optional Studies 10 ECTS cr: Applied Computing								
	Change Optional Sudies 10 ECTS cr	10.0			3.0		7.0	

Preparatory Module for the Orientation: 1. Information Processing Engineering	30.0	30.0 30.0 30.0 30.0 30.0
Preparatory Module for the Orientation: 1. Information Processing Engineering	60.0	60.0 60.0
Preparatory Module for the Orientation: 2. Applied Computing	30.0	30.0 30.0 30.0 30.0 30.0
Preparatory Module for the Orientation: 2. Applied Computing	60.0	60.0 60.0
Preparatory Module for the Orientation: 3. Embedded Systems	30.0	30.0 30.0 30.0 30.0 30.0
Preparatory Module for the Orientation: 3. Embedded Systems	60.0	60.0 60.0

SUPPLEMENTARY MODULES 2017-2018

Year/Term1st autumn1st spring2nd autumn2nd spring3rd autumn3rd spring

CodeTitleECTS123412341234

Supplementary Module 15 ECTS cr						
	Change Sublementary Studies 15 ECTS cr	15.0				
Supplementary Module: 1. Information Processing Engineering, 15 ECTS cr						
031022P	Numerical Analysis	5.0			0.0	
521337A	Digital Filters	5.0				0.0
521330A	Telecommunication Engineering	5.0				0.0
Supplementary Module: 2. Applied Computing 15 ECTS cr						
521151A	Applied computing project I	10.0	0.0		0.0	
	Introduction to Social Network Analysis	5.0				0.0
Supplementary Module: 3. Embedded Systems 15 ECTS cr						
521302A	Circuit Theory 1	5.0		0.0		
521431A	Principles of Electronics Design	5.0			0.0	
521337A	Digital Filters	5.0				0.0
Another Supplementary Module						
Supplementary Module: 4. Electrical Engineering, 15 ECTS cr						
521302A	Circuit Theory 1	5.0		0.0		
521431A	Principles of Electronics Design	5.0				0.0
521077P	Introduction to Electronics	5.0		0.0		
521329A	Hands-on Course in Wireless Communication	5.0	0.0			
521104P	Introduction to Material Physics	5.0			0.0	
521071A	Principles of Semiconductor Devices	5.0				0.0
521303A	Circuit Theory 2	5.0		0.0		
521432A	Electronics Design I	5.0	0.0			
521404A	Digital Techniques 2	5.0		0.0		
521384A	Basics in Radio Engineering	5.0	0.0			
521070A	Introduction to Microfabrication Techniques	5.0		0.0		
521304A	Filters	5.0			0.0	
521092A	Electronic Measurement Techniques	5.0				0.0
521307A	Laboratory Exercises on Analogue Electronics	5.0	0.0	0.0		
Supplementary Module: 5. Information Processing Science, 15 ECTS cr						
810136P	Introduction to information processing sciences	5.0	0.0	0.0		
811122P	Introduction to Programming	5.0	0.0	0.0		
813316A	Business Process Modeling	5.0				0.0

811177P	Humans as Users and Developers of Information Technology	5.0		0.0		
811375A	User Interface Programming	5.0	0.0	0.0		
811379A	Introduction to Human-computer Interaction	5.0			0.0	
815345A	Software architectures	5.0			0.0	0.0
811174P	Introduction to Software Business	5.0				0.0
812341A	Object-oriented Programming	5.0				0.0
812342A	Object Oriented Analysis and Design	5.0	0.0			
812305A	Information Systems in Organizations	5.0		0.0		
811167P	Introduction to Information Systems Design	5.0			0.0	
812332A	Information systems planning	5.0		0.0		
811394A	Database systems	5.0				0.0
811395A	Basics of Databases	5.0			0.0	
810122P	Computer Architecture	5.0			0.0	
811168P	Information Security	5.0	0.0			
811391A	Requirements Engineering	5.0		0.0		

Supplementary Module: 6. Industrial Engineering and Management, 15 ECTS cr

555225P	Basics of industrial engineering and management	5.0	0.0	0.0		
555285A	Project management	5.0	0.0			
555242A	Product development	5.0	0.0			
555286A	Process and quality management	5.0				0.0
555264P	Managing well-being and quality of working life	5.0			0.0	0.0

Supplementary Module: 7. Working life & Entrepreneurship, 15 ECTS cr

724811P	Entrepreneuring for Tomorrow	5.0	0.0	0.0		
724812P	Building Change Through Entrepreneurship	5.0			0.0	0.0
724813P	Entrepreneurship in Action	5.0	0.0	0.0	0.0	0.0
	Introduction to Business Developmen	5.0	0.0	0.0		
724815P	Entrepreneurial Assignment	5.0	0.0	0.0	0.0	0.0
910003S	Building Business through Creativity and Collaboration	5.0	0.0	0.0		

Supplementary Module: 8. Economics and Bussiness Administration*, 15 ECTS cr

	* The module is intended only for students of Applied Computing (in MSc).	0.0				

724103P	Strategic Management	5.0		0.0		
724105P	Management Accounting	5.0				0.0
724106P	Principles of Marketing	5.0	0.0			
724109P	Investment Decisions	5.0			0.0	
724110P	Introductory Economics	5.0			0.0	
Supplementary Module: 9. Statistics / Optional Courses, 15 ECS cr:						
805351A	Linear Regression	5.0			0.0	
805350A	Estimation and Test Theory	5.0				
805353A	Statistical Software	5.0				
805349A	Likelyhood and Bayesian Inference	5.0				
805306A	Introduction to Multivariate methods	5.0				
Supplementary module primarily consists of a preparatory module of another orientation (Information Processing Engineering, Applied Computing or Embed						
Sum						
Sum						

University of Oulu

Information and Communication Technologies (ICTs)

Master's Programme in Computer Science and Engineering 2017-2018

Master of Science (Technology)

I Information Processing Engineering Orientation

Information Processing Engineering Orientation, Basic Module, 45 ECTS cr						
031025A	Introduction to Optimization	5.0	5.0			
521348S	Statistical Signal Processing	5.0	5.0			
813621S	Research Methods	5.0	2.5	2.5		
521279S	Signal Processing Systems	5.0		5.0		
521466S	Machine Vision	5.0			5.0	
521289S	Machine Learning	5.0			5.0	
521288S	Multiprocessor Programming	5.0			2.5	2.5
521260S	Programmable Web Project	5.0			2.5	2.5

521161S	Multi-modal Data Fusion	5.0					5.0			
Information Processing Engineering Orientation, Advanced Modules (only one module is selected), 42 ECTS cr										
Advanced Module: 1. Signal Processing / Obligatory Courses, 20 ECTS cr:										
521155S	Computer Security	5.0					5.0			
521404A	Digital Techniques 2	5.0						5.0		
521281S	Application Specific Signal Processors	5.0					5.0			
521321S	Elements of Information Theory and Coding	5.0						5.0		
Advanced Module: 1. Signal Processing / Optional Courses, 22 ECTS cr:										
	Choose f.g. from the following courses total 22 ECTS cr. You can also invest the exchange studies in this.	22.0	5.0	5.0	5.0	2.0			5.0	
521323S	Wireless Communications I	5.0		0.0				0.0		
521273S	Biosignal Processing I	5.0		0.0				0.0		
477607S	Advanced Control and Systems Engineering	5.0			0.0				0.0	
521489S	Research Work on Information Processing	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
521324S	Communication Signal Processing I	5.0			0.0				0.0	
521493S	Computer Graphics	7.0				0.0				0.0
521445S	Digital Techniques 3	6.0			0.0	0.0			0.0	0.0
521325S	Communication Signal Processing II	5.0	0.0				0.0			
Advanced Module: 2. Intelligent Systems / Obligatory Courses, 17 ECTS cr:										
521493S	Computer Graphics	7.0				7.0				
521285S	Affective Computing	5.0					5.0			
521156S	Towards Data Mining	5.0					5.0			
Advanced Module: 2. Intelligent Systems / Optional Courses, 25 ECTS cr:										
	Choose f.g. from the following courses total 25 ECTS cr. You can also invest the exchange studies in this.	25.0	2.5	7.5			5.0	5.0	5.0	
521290S	Distributed Systems	5.0			0.0				0.0	
477624S	Control System Methods	5.0	0.0				0.0			
521489S	Research Work on Information Processing	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
521273S	Biosignal Processing I	5.0		0.0				0.0		
477607S	Advanced Control and Systems Engineering	5.0			0.0				0.0	
802633S	Statistical Pattern Recognition	10.0			0.0	0.0			0.0	0.0
521283S	Big Data Processing and Applications	5.0				0.0				0.0

477525S	Computational intelligence in automation	5.0		0.0				0.0		
Advanced Module: 3. Biomedical Engineering / Obligatory Courses, 20 ECS cr:										
521284S	Biomedical Engineering Project	5.0	5.0							
521093S	Biomedical Instrumentation	5.0							5.0	
521273S	Biosignal Processing I	5.0		5.0						
521282S	Biosignal Prosessing II	5.0				5.0				
Advanced Module: 3. Biomedical Engineering / Optional Courses, 22 ECS cr:										
	Choose e.g. from the following courses total 22 ECTS cr. You can also invest the exchange studies in this.	22.0			2.0		10.0	10.0		
764634S	Medical physics and imaging	6.0	0.0				0.0			
757314A	Basics of bioinformatics	5.0	0.0	0.0			0.0	0.0		
521285S	Affective Computing	5.0					0.0			
521097S	Wireless Measurements	5.0			0.0				0.0	
080920S	Diagnostic Imaging	5.0								
080926A	Introduction to Biomedical Imaging Methods	1.0-3.0								
Supplementary Module,										
	Supplementary module can include for example courses from the basic module of another orientation.	0.0	0.0		0.0					
Common Obligatory Courses, 33 ECTS cr										
521013A	Advanced Practical Training	3.0				3.0				
521993S	Master's Thesis in Computer Engineering	30.0						5.0	5.0	20.0
Information Processing Engineering Orientation 1. Advanced Module: Signal Processing	30.0	30.0	30.0	30.0						
Information Processing Engineering Orientation 1. Advanced Module: Signal Processing	60.0	60.0								
Information Processing Engineering Orientation 2. Advanced Module: Intelligent Systems	30.0	30.0	30.0	30.0						
Information Processing Engineering Orientation 2. Advanced Module: Intelligent Systems	60.0	60.0								
Information Processing Engineering Orientation 3. Advanced Module: Biomedical Engineering	30.0	30.0	30.0	30.0						
Information Processing Engineering Orientation 3. Advanced Module: Biomedical Engineering	60.0	60.0								
II Applied Computing Orientation										
Basic Module, 42 ECTS cr										
521148S	Ubiquitous Computing Fundamentals	5.0	2.5	2.5						

813621S	Research Methods	5.0	2.5	2.5						
521479S	Software Project	7.0	3.5	3.5						
521158S	Natural Language Processing and Text Mining	5.0		5.0						
811395A	Basics of Databases	5.0			5.0					
521290S	Distributed Systems	5.0			5.0					
521147S	Mobile and Social Computing	5.0			2.5	2.5				
521260S	Programmable Web Project	5.0			2.5	2.5				
Advanced Modules, 45 ECTS cr										
Advanced Module: 1. Applied Computing Technology, Obligatory Courses, 10 ECTS cr										
521152S	Applied Computing Project II	10.0					2.5	2.5	2.5	2.5
Advanced Module: 1. Applied Computing Technology / Optional Courses, 35 ECTS cr										
	Choose from the following courses total 35 ECTS cr. You can also invest the exchange student in this.	35.0	6.0	2.0		7.0	12.5	2.5	2.5	2.5
521489S	Research Work on Information Processing	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
812342A	Object Oriented Analysis and Design	5.0	0.0				0.0			
812341A	Object-oriented Programming	5.0				0.0				0.0
812331A	Interaction Design	5.0	0.0				0.0			
815657S	Open Source Software Development	5.0	0.0	0.0			0.0	0.0		
815305A	Real Time Distributed Software Development	5.0	0.0	0.0			0.0	0.0		
817603S	System Design Methods for Information Systems	5.0	0.0				0.0			
813625S	Information Systems Theory	5.0	0.0	0.0			0.0	0.0		
521283S	Big Data Processing and Applications	5.0				0.0				0.0
521493S	Computer Graphics	7.0				0.0				0.0
521285S	Affective Computing	5.0	0.0				0.0			
Advanced Module: 2. Applied Computing Business / Obligatory Courses, 10 ECTS cr										
		0.0								
724206A	Strategic Marketing Management	5.0				5.0				
724201A	Internationalization	5.0						5.0		
Advanced Module: 2. Applied Computing Business / Optional Courses, 35 ECTS cr										
	Choose f.g. from the following courses total 35 ECTS cr. You can also invest the exchange student in this.	35.0	6.0	2.0		2.0	15.0		5.0	5.0
806118P	Introduction to Statistics	5.0			0.0				0.0	
806119P	A Second Course in Statistics	5.0				0.0				0.0
521489S	Research Work on Information Processing	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
555314S	Management Information Systems	5.0			0.0	0.0			0.0	0.0
724050A	Bachelor Thesis	10.0			0.0	0.0			0.0	0.0
724202A	Managing Multinationals	5.0			0.0				0.0	
724203A	Financial Statement Analysis	5.0	0.0				0.0			
724204A	Management Control	5.0			0.0				0.0	

724207A	Financial Decisions	5.0			0.0				0.0	
724208A	Portfolio Theory	5.0	0.0				0.0			
724209A	Monetary Economics	5.0	0.0				0.0			
724210A	Global Economics	5.0		0.0				0.0		
724205A	Distribution and Retail Management	5.0				0.0				0.0
Supplementary Module										
	Supplementary module can include for example courses from the basic module of another orientation.	0.0								
Common Obligatory Courses										
521993S	Master's Thesis in Computer Engineering	30.0						10.0	10.0	10.0
521013A	Advanced Practical Training	3.0				3.0				
Applied Computing Orientation, 1. Advanced Module: Applied Computing Technology	30.0	30.0	30.0	30.0						
Applied Computing Orientation, 1. Advanced Module: Applied Computing Technology	60.0	60.0								
Applied Computing Orientation, 2. Advanced Module: Applied Computing Business	30.0	30.0	30.0	30.0						
Applied Computing Orientation, 2. Advanced Module: Applied Computing Business	60.0	60.0								
III Embedded Systems Orientation										
Basic Module 32 ECTS cr										
521479S	Software Project	7.0	3.5	3.5						
521279S	Signal Processing Systems	5.0		5.0						
521404A	Digital Techniques 2	5.0		5.0						
521288S	Multiprocessor Programming	5.0			2.5	2.5				
521423S	Embedded System Project	5.0			2.5	2.5				
521340S	Communication Networks I	5.0						5.0		
Advanced Modules: 1. Embedded Systems Electronics / Obligatory Courses, 16 ECTS cr										
521303A	Circuit Theory 2	5.0		5.0						
521445S	Digital Techniques 3	6.0			3.0	3.0				
521281S	Application Specific Signal Processors	5.0					5.0			
Advanced Modules: 1. Embedded Systems Electronics / Optional Courses, 39 ECTS cr										
	Choose from the following courses total 39 ECTS cr. You can also invest the exchange studies in this.	39.0	8.0		7.0	4.0	10.0	10.0		
813621S	Research Methods	5.0	0.0	0.0			0.0	0.0		
521405A	Electronic System Design	5.0	0.0				0.0			
521323S	Wireless Communications I	5.0		0.0				0.0		
521443S	Electronics Design II	5.0	0.0				0.0			
521088S	Optoelectronics	5.0			0.0				0.0	
	Research Work on Information									

521489S	Processing	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
521348S	Statistical Signal Processing	5.0				0.0				
521385S	Mobile Telecommunication Systems	5.0		0.0				0.0		
521304A	Filters	5.0			0.0				0.0	
521328A	Simulations and Tools for Telecommunications	5.0		0.0				0.0		
Advanced Modules: 2. Embedded Systems Software / Obligatory Courses, 20 ECTS cr										
	Computer Security	5.0	5.0							
	Data Mining	5.0	5.0							
521290S	Distributed Systems	5.0			5.0					
521260S	Programmable Web Project	5.0			2.5	2.5				
Advanced Modules: 2. Embedded Systems Software / Optional Courses, 35 ECTS cr										
	Choose e.g from the following courses total 35 ECTS cr. You can also invest the exchange studies in this.	35.0	1.5	1.5	2.5	4.5	15.0	10.0		
813621S	Research Methods	5.0	0.0	0.0			0.0	0.0		
812342A	Object Oriented Analysis and Design	5.0	0.0				0.0			
812341A	Object-oriented Programming	5.0				0.0				0.0
521323S	Wireless Communications I	5.0		0.0				0.0		
521489S	Research Work on Information Processing	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
521281S	Application Specific Signal Processors	5.0	0.0				0.0			
521328A	Simulations and Tools for Telecommunications	5.0		0.0				0.0		
Supplementary Module, 20 ECTS cr										
	Supplementary module can include for example courses from the basic module of another orientation.	0.0								
Common Obligatory Courses, 33 ECTS cr										
521013A	Advanced Practical Training	3.0				3.0				
521993S	Master's Thesis in Computer Engineering	30.0							15.0	15.0
Embedded Systems Orientation, 1. Advanced Module: Embedded Systems Electronics	30.0	30.0	30.0	30.0						
Embedded Systems Orientation, 1. Advanced Module: Embedded Systems Electronics	60.0	60.0								
Embedded Systems Orientation, 2. Advanced Module: Embedded Systems Software	30.0	30.0	30.0	30.0						
Embedded Systems Orientation, 2. Advanced Module: Embedded Systems Software	60.0	60.0								

Master's Programme in English (2 years), Master's Programme

Year/Term1st autumn1st spring2nd autumn2nd spring

CodeTitleECTS12341234

Master's Programme in English (2 years), Master's Programme in Computer Science and Engineering 2017-2018

	Computer Science and Engineering, Master of Science (Technology), 120 ECTS cr	120.0								

Basic Module, 20 ECTS cr

900017Y	Survival Finnish Course	2.0	2.0							
900013Y	Beginners' Finnish Course 1	3.0		3.0						
813621S	Research Methods	5.0	2.5	2.5						
521145A	Human-Computer Interaction	5.0		5.0						
521260S	Programmable Web Project	5.0			2.5	2.5				

Specialisation Options (only one options is selected), 67 ECTS cr

Specialisation Options, 1. Computer Vision and Signal Processing , Compulsory Courses 67 ECTS cr

031025A	Introduction to Optimization	5.0	5.0							
521348S	Statistical Signal Processing	5.0	5.0							
521279S	Signal Processing Systems	5.0		5.0						
521466S	Machine Vision	5.0			5.0					
521289S	Machine Learning	5.0			5.0					
521288S	Multiprocessor Programming	5.0			2.5	2.5				
521493S	Computer Graphics	7.0				7.0				
521285S	Affective Computing	5.0					5.0			
521161S	Multi-Modal Data Fusion	5.0					5.0			
521156S	Towards Data Mining	5.0					5.0			
521321S	Elements of Information Theory and Coding	5.0						5.0		
521281S	Application Specific Signal Processors	5.0						5.0		
521273S	Biosignal Processing I	5.0						5.0		

Specialisation Options, 1. Computer Vision and Signal Processing , Recommended Optional Studies

521495A	Artificial Intelligence	5.0							0.0	
521337A	Digital Filters	5.0							0.0	
521348S	Statistical Signal Processing	5.0								0.0
521147S	Mobile and Social Computing	5.0							0.0	0.0
521467A	Digital Image Processing	5.0					0.0			
521489S	Research Work on Information Processing	8.0					0.0	0.0		
521148S	Ubiquitous Computing Fundamentals	5.0					0.0	0.0		
521283S	Big Data Processing and Applications	5.0				0.0				0.0

Specialisation Options, 2. Ubiquitous Computing , Compulsory Courses 55 ECTS cr

521148S	Ubiquitous Computing Fundamentals	5.0	2.5	2.5						
521151A	Applied Computing Project I	10.0	2.5	2.5	2.5	2.5				
812331A	Interaction Design	5.0	5.0							

521147S	Mobile and Social Computing	5.0			2.5	2.5				
521290S	Distributed Systems	5.0			5.0					
812650S	Advanced Topics in Human-Centred Design	5.0			5.0					
521283S	Big Data Processing and Applications	5.0				5.0				
521152S	Applied Computing Project II	10.0					2.5	2.5	2.5	2.5
521158S	Natural Language Processing and Text Mining	5.0						5.0		
Specialisation Options, 2. Ubiquitous Computing , Recommended Optional Studies, 12 ECTS cr										
	Selected e.g.12 ECTS credits for this	12.0					6.0	1.0	2.5	2.5
521479S	Software Project	7.0					0.0	0.0		
521149S	Special Course in Information Technology	5.0-8.0					0.0	0.0	0.0	0.0
521489S	Research Work on Information Processing	8.0					0.0	0.0	0.0	0.0
521154S	UBISS - International UBI Summer School	5.0				0.0				0.0
815657S	Open Source Software Development	5.0					0.0	0.0		
815305A	Real Time Distributed Software Development	5.0					0.0	0.0		
817603S	System Design Methods for Information Systems	5.0					0.0			
813625S	Information Systems Theory	5.0					0.0	0.0		
521423S	Embedded System Project	5.0							0.0	0.0
521286A	Computer Systems	8.0					0.0	0.0		
521275A	Embedded Software Project	8.0						0.0	0.0	
812671S	Usability Testing (or 812650S)	5.0							0.0	0.0
Common 1. Compulsory, Computer Vision and Signal Processing, 33 ECTS cr										
521013A	Advanced Practical Training	3.0				3.0				
521993S	Master's Thesis in Computer Engineering	30.0							15.0	15.0
Common 2. Ubiquitous Computing, 33 ECTS cr										
521013A	Advanced Practical Training	3.0					3.0			
521993S	Master's Thesis in Computer Engineering	30.0					5.0	5.0	10.0	10.0
Specialisation Options, 1. Computer Vision and Signal Processing	30.0	30.0	30.0	30.0						
Specialisation Options, 1. Computer Vision and Signal Processing	60.0	60.0								
Specialisation Options, 2. Ubiquitous Computing	30.0	30.0	30.0	30.0						
Specialisation Options, 2. Ubiquitous Computing	60.0	60.0								

Tutkintorakenteet

International Master's Programme in Computer Science and Engineering 2017-

Tutkintorakenteen tila: published

Lukuvuosi: 2017-18

Lukuvuoden alkamispäivämäärä: 01.08.2017

Basic Module (20 op)

900013Y: Beginners' Finnish Course 1, 3 op
521145A: Human-Computer Interaction, 5 op
521260S: Programmable Web Project, 5 op
813621S: Research Methods, 5 op
900017Y: Survival Finnish Course, 2 op

Specialisation Options, Compulsory Courses (55 - 67 op)

Computer Vision and Signal Processing

521285S: Affective Computing, 5 op
521281S: Application Specific Signal Processors, 5 op
521273S: Biosignal Processing I, 5 op
521493S: Computer Graphics, 7 op
521321S: Elements of Information Theory and Coding, 5 op
031025A: Introduction to Optimization, 5 op
521289S: Machine Learning, 5 op
521466S: Machine Vision, 5 op
521161S: Multi-Modal Data Fusion, 5 op
521288S: Multiprocessor Programming, 5 op
521279S: Signal Processing Systems, 5 op
521348S: Statistical Signal Processing, 5 op
521156S: Towards Data Mining, 5 op

Ubiquitous Computing

812650S: Advanced Topics in Human-Centred Design, 5 op
521151A: Applied Computing Project I, 10 op
521152S: Applied Computing Project II, 10 op
521283S: Big Data Processing and Applications, 5 op
521290S: Distributed Systems, 5 op
812331A: Interaction Design, 5 op
521147S: Mobile and Social Computing, 5 op
521158S: Natural Language Processing and Text Mining, 5 op
521148S: Ubiquitous Computing Fundamentals, 5 op

Specialisation Options, Recommended Optional Studies

Please note that if the scope of the degree (120 ECTS credits) is filled up by compulsory studies you do not have to choose any optional studies.

Computer Vision and Signal Processing

A452291: Computer Vision and Signal Processing, advanced module, optionals, 10 - 20 op
optionals
521495A: Artificial Intelligence, 5 op
521337A: Digital Filters, 5 op
521348S: Statistical Signal Processing, 5 op
521147S: Mobile and Social Computing, 5 op
521467A: Digital Image Processing, 5 op
521489S: Research Work on Information Processing, 8 op
521148S: Ubiquitous Computing Fundamentals, 5 op
521283S: Big Data Processing and Applications, 5 op

Ubiquitous Computing

A452292: Ubiquitous Computing, advanced module, optionals, 17 - 20 op
optionals
521479S: Software Project, 7 op
521149S: Special Course in Information Technology, 5 - 8 op
521489S: Research Work on Information Processing, 8 op
521154S: UBISS - International UBI Summer School, 5 op
815657S: Open Source Software Development, 5 op
815305A: Real Time Distributed Software Development, 5 op
817603S: System Design Methods for Information Systems, 5 op
813625S: Information Systems Theory, 5 op
521423S: Embedded System Project, 5 op
521286A: Computer Systems, 8 op
521275A: Embedded Software Project, 8 op
812671S: Usability Testing, 5 op

Common Compulsory (33 op)

521013A: Advanced Practical Training, 3 op
521993S: Master's Thesis in Computer Engineering, 30 op

Degree Programme in Information Engineering, B.Sc.

Tutkintorakenteen tila: published

Lukuvuosi: 2017-18

Lukuvuoden alkamispäivämäärä: 01.08.2017

Basic and Intermediate Studies (130 op)

A452120: Basic and Intermediate Studies, Information Engineering, 120 - 150 op
Second official language, select 2
901048Y: Second Official Language (Swedish), Written Skills, 1 op
901049Y: Second Official Language (Swedish), Oral Skills, 1 op
900081Y: Second Official Language (Finnish), Written Skills, 1 - 2 op
900082Y: Second Official Language (Finnish), Oral Skills, 1 - 3 op
Compulsory studies
521002P: Orientation to Computer Science and Engineering, 5 op
031010P: Calculus I, 5 op
031078P: Matrix Algebra, 5 op
521141P: Elementary Programming, 5 op
031075P: Calculus II, 5 op
031021P: Probability and Mathematical Statistics, 5 op
902011P: Technical English 3, 6 op
031077P: Complex analysis, 5 op
031023P: Mathematical Structures for Computer Science, 5 op

030005P: Information Skills, 1 op
031076P: Differential Equations, 5 op
761113P: Electricity and magnetism, 5 op
521159P: Principles of Digital Fabrication, 5 op
521160P: Introduction to Artificial Intelligence, 5 op

Compulsory Intermediate Studies

521109A: Electrical Measurement Principles, 5 op
521301A: Digital Techniques 1, 8 op
521150A: Introduction to Internet, 5 op
521286A: Computer Systems, 8 op
521457A: Software Engineering, 5 op
521145A: Human-Computer Interaction, 5 op
811312A: Data Structures and Algorithms, 5 op
031080A: Signal Analysis, 5 op
521453A: Operating Systems, 5 op
521495A: Artificial Intelligence, 5 op
521467A: Digital Image Processing, 5 op

Complusory Bachelor's Thesis

523991A: Bachelor's Thesis / Information Engineering, 8 op
900060A: Technical Communication, 2 op

Module preparing for the option (15 op)

Information Technology

A452121: Module Preparing for the Option, Information Technology, 10 - 30 op

Compulsory studies

031022P: Numerical Analysis, 5 op
521337A: Digital Filters, 5 op
521330A: Telecommunication Engineering, 5 op

Applied computing

A452149: Module Preparing for the Option, Applied computing, 10 - 30 op

Obligatory studies

521151A: Applied Computing Project I, 10 op
521157A: Introduction to Social Network Analysis, 5 op

Embedded Systems

A452123: Module Preparing for the Option, Embedded Systems, 10 - 30 op

Compulsory studies

521302A: Circuit Theory 1, 5 op
521431A: Principles of Electronics Design, 5 op
521337A: Digital Filters, 5 op

Optional Studies

Students can choose optional courses to complete the 10 ECTS credit. Practical training, 3 ECTS credits, can also be included. (521012A Practical Training)

Supplementary modules

Recommended modules in the Finnish language study guide.

H452229: Other Supplementary Module (Computer Science and Engineering), 15 op

Supplementary module primarily consists of a preparatory module of another orientation (Information Processing Engineering, Applied Computing or Embedded Systems). Another alternative is to select the *supplementary module from the fields of Electrical Engineering, Information Processing Science, Industrial Engineering and Management, Working life & Entrepreneurship, or Economics and Management. In all cases the extent of the supplementary module is 15 ECTS cr.*

- A452127: Module Preparing for the Option, Artificial Intelligence, 20 op
- A452149: Module Preparing for the Option, Applied computing, 10 - 30 op
  - *Obligatory studies*
    - 521151A: Applied Computing Project I, 10 op
    - 521157A: Introduction to Social Network Analysis, 5 op
- A452126: Module Preparing for the Option, Computer Engineering, 20 op

Supplementary Module: Electrical Engineering (15 ECTS cr)

- 521302A: Circuit Theory 1, 5 op
- 521431A: Principles of Electronics Design, 5 op
- 521077P: Introduction to Electronics, 5 op
- 521329A: Hands-on Course in Wireless Communication, 5 op
- 521104P: Introduction to Material Physics, 5 op
- 521071A: Principles of Semiconductor Devices, 5 op
- 521303A: Circuit Theory 2, 5 op
- 521432A: Electronics Design I, 5 op
- 521404A: Digital Techniques 2, 5 op
- 521384A: Basics in Radio Engineering, 5 op
- 521070A: Introduction to Microfabrication Techniques, 5 op
- 521304A: Filters, 5 op
- 521092A: Electronic Measurement Techniques, 5 op
- 521307A: Laboratory Exercises on Analogue Electronics, 5 op

Supplementary Module: Information Processing Science. (15 ECTS cr)

- 810136P: Introduction to Information Processing Sciences, 5 op
- 811122P: Introduction to Programming, 5 op
- 813316A: Business Process Modeling, 5 op
- 811177P: Humans as Users and Developers of Information Technology, 5 op
- 811375A: User Interface Programming, 5 op
- 811379A: Basics of Human Computer Interaction, 5 op
- 815345A: Software Architectures, 5 op
- 811174P: Introduction to Software Business, 5 op
- 812341A: Object-Oriented Programming, 5 op
- 812342A: Object Oriented Analysis and Design, 5 op
- 812305A: Information Systems in Organisations, 5 op
- 811167P: Introduction to Information Systems Design, 5 op
- 812332A: Information Systems Design, 5 op
- 811394A: Database systems, 5 op
- 811395A: Basics of Databases, 5 op
- 810122P: Computer Architecture, 5 op
- 811168P: Information Security, 5 op
- 811391A: Requirements Engineering, 5 op

Supplementary Module: Industrial Engineering and Management (15 ECTS cr)

- 555225P: Basics of industrial engineering and management, 5 op
- 555285A: Project management, 5 op
- 555242A: Product development, 5 op
- 555286A: Process and quality management, 5 op
- 555264P: Managing well-being and quality of working life, 5 op

Supplementary Module: Working life & Entrepreneurship (15 ECTS cr)

- A631401: Entrepreneurship, Basic Studies, 25 op
  - *Choose five of the following courses (25 ECTS)*
    - 724811P: Entrepreneuring for Tomorrow, 5 op
    - 724812P: Building Change Through Entrepreneurship, 5 op
    - 724813P: Entrepreneurship in Action, 5 op
    - 724814P: Introduction to Business Development, 5 op
    - 724815P: Entrepreneurial Assignment, 5 op
    - 724816P: Building Business Through Creativity and Collaboration, 5 op

Supplementary Module: Economics and Management (15 ECTS cr) (The module is intended only for students of Applied Computing (in MSc).)*

- 724103P: Strategic Management, 5 op
- 724105P: Management Accounting, 5 op
- 724106P: Principles of Marketing, 5 op
- 724109P: Investment Decisions, 5 op

724110P: Introductory Economics, 5 op

Statistics

805351A: Linear Regression, 5 op
805350A: Estimation and Test Theory, 5 op
805353A: Statistical Software, 5 op
805349A: Likelihood and Bayesian Inference, 5 op
805306A: Introduction to Multivariate methods, 5 op

Basic Business Studies

A635801: Basic Business Studies, 25 - 40 op

Student can select individual courses or complete the whole minor (minimum 5 courses, 25 ECTS).

724830P: Introduction to Accounting and Financial Management, 5 op
724831P: Introduction to Business Law, 5 op
724832P: Economics and The Business Environment, 5 op
724833P: Introduction to Entrepreneurship, 5 op
724834P: Basics of Marketing and Sales, 5 op
724835P: Basics of Management and Organizations, 5 op
724836P: Introduction to Corporate Social Responsibility, 5 op
724837P: Understanding and managing a business as a dynamic whole - business simulation game, 5 op

International Master's Programme in Biomedical Engineering: Signal and Image Processing (BME-SIP)

Tutkintorakenteen tila: published

Lukuvuosi: 2017-18

Lukuvuoden alkamispäivämäärä: 01.08.2017

Basic Module, Compulsory Courses (57 op)

Note: Courses 'An Introduction to Computer Vision Methods for Biomedical Images' and 'Function and Analysis of Cardiovascular System' are both compulsory courses. They have the same course code (521149S) and information about these 2 different courses can be found in WebOodi course search.

521285S: Affective Computing, 5 op
080925A: Anatomy and Physiology for Biomedical Engineering, 5 op
041201A: Basics in eHealth, 5 op
521284S: Biomedical Engineering Project, 5 op
521093S: Biomedical Instrumentation, 5 op
521273S: Biosignal Processing I, 5 op
521282S: Biosignal Processing II, 5 op
521242A: Introduction to Biomedical Engineering, 5 op
521289S: Machine Learning, 5 op
521149S: Special Course in Information Technology, 5 - 8 op
900017Y: Survival Finnish Course, 2 op

Recommended Optional Studies (30 op)

A452294: Biomedical Engineering: Signal and Image Processing (BME-SIP), advanced module, optional studies, 31 op

BME-SIP, optional studies, 30 ECTS cr

521156S: Towards Data Mining, 5 op
031025A: Introduction to Optimization, 5 op
521348S: Statistical Signal Processing, 5 op
080927S: Connected Health and mHealth, 5 op
521279S: Signal Processing Systems, 5 op
521240S: Biophotonics and Biomedical Optics, 5 op

521161S: Multi-Modal Data Fusion, 5 op
900013Y: Beginners' Finnish Course 1, 3 op
521124S: Sensors and Measuring Techniques, 5 op
080920S: Diagnostic Imaging, 5 op
900053Y: Beginners' Finnish Course 2, 5 op
521337A: Digital Filters, 5 op
521466S: Machine Vision, 5 op
521495A: Artificial Intelligence, 5 op
521097S: Wireless Measurements, 5 op
080916S: Biomechanics of Human Movement, 5 op
521288S: Multiprocessor Programming, 5 op
521493S: Computer Graphics, 7 op
521283S: Big Data Processing and Applications, 5 op
080926A: Introduction to Biomedical Imaging Methods, 1 - 3 op
521149S: Special Course in Information Technology, 5 - 8 op

Common Compulsory (33 op)

The Master's Thesis requires a written maturity exam.

521013A: Advanced Practical Training, 3 op
522987S: Master's Thesis in Biomedical Engineering, 30 op
521009S: The Maturity Test for Master`s Degree, 0 op

MSc. Engineering, Computer Science and Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2017-18

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Module of the Basic Module (32 - 45 op)

Compulsory, choose one of the Basic Module (32 - 45 ECTS cr). Advanced modules are approximately 42-55 ECTS cr in total.

Information Technology

A452221: Module of the Option, Information Technology, 34 - 35 op
All compulsory
031025A: Introduction to Optimization, 5 op
521348S: Statistical Signal Processing, 5 op
813621S: Research Methods, 5 op
521279S: Signal Processing Systems, 5 op
521466S: Machine Vision, 5 op
521289S: Machine Learning, 5 op
521288S: Multiprocessor Programming, 5 op
521260S: Programmable Web Project, 5 op
521161S: Multi-Modal Data Fusion, 5 op

Applied computing

A452224: Module of the Option, Applied computing, 35 - 62 op
Obligatory courses
521148S: Ubiquitous Computing Fundamentals, 5 op
813621S: Research Methods, 5 op
521479S: Software Project, 7 op

521158S: Natural Language Processing and Text Mining, 5 op
811395A: Basics of Databases, 5 op
521290S: Distributed Systems, 5 op
521147S: Mobile and Social Computing, 5 op
521260S: Programmable Web Project, 5 op

Embedded Systems

A452223: Module of the Option, Embedded Systems, 30,5 - 32 op
All compulsory
521479S: Software Project, 7 op
521279S: Signal Processing Systems, 5 op
521404A: Digital Techniques 2, 5 op
521288S: Multiprocessor Programming, 5 op
521423S: Embedded System Project, 5 op
521340S: Communications Networks I, 5 op

Advanced module (42 op)

Information Technology, 1. Advanced Module in Signal Processing

A452271: Advanced Module/Information Technology, Signal Processing (obligatory), 13,5 - 20 op
Obligatory Courses, 20 ECTS cr
521155S: Computer Security, 5 op
521404A: Digital Techniques 2, 5 op
521281S: Application Specific Signal Processors, 5 op
521321S: Elements of Information Theory and Coding, 5 op
A452272: Advanced Module/Information Technology, Signal Processing (optional), 15 - 22 op
Optional courses: , Choose from the following 22 ECTS cr. Studies that have been completed in the other land can be placed here.
521323S: Wireless Communications I, 5 op
521273S: Biosignal Processing I, 5 op
477607S: Advanced Control and Systems Engineering, 5 op
521489S: Research Work on Information Processing, 8 op
521324S: Statistical Signal Processing II, 5 op
521493S: Computer Graphics, 7 op
521445S: Digital Techniques 3, 6 op
521325S: Communication Signal Processing, 5 op

Information Technology, 2. Advanced Module in Intelligent Systems

A452273: Advanced Module/Information Technology, Intelligent Systems (obligatory), 14 - 17 op
Obligatory courses
521493S: Computer Graphics, 7 op
521285S: Affective Computing, 5 op
521156S: Towards Data Mining, 5 op
A452274: Advanced Module/Information Technology, Intelligent Systems (optional), 18 - 25 op
Optional courses, Choose from the following 25 ECTS cr. Studies that have been completed in the other land can be placed here.
521290S: Distributed Systems, 5 op
477624S: Control System Methods, 5 op
521489S: Research Work on Information Processing, 8 op
521273S: Biosignal Processing I, 5 op
477607S: Advanced Control and Systems Engineering, 5 op
802633S: Statistical Pattern Recognition, 10 op
521283S: Big Data Processing and Applications, 5 op
477525S: Computational intelligence in automation, 5 op

Information technology, Advanced Module: 3. Biomedical Information Engineering

A452275: Advanced Module/Information Technology, Biomedical Information Engineering (obligatory), 11 - 20 op
Obligatory courses

521284S: Biomedical Engineering Project, 5 op
521093S: Biomedical Instrumentation, 5 op
521273S: Biosignal Processing I, 5 op
521282S: Biosignal Processing II, 5 op
A452276: Advanced Module/Information Technology, Biomedical Information Engineering (optional), 20 - 24 op
Optional courses, Choose from the following 22 ECTS cr. Studies that have been completed in the other land can be placed here.
764634S: Medical physics and imaging, 5 op
757314A: Basics of bioinformatics, 5 op
521285S: Affective Computing, 5 op
521097S: Wireless Measurements, 5 op
080920S: Diagnostic Imaging, 5 op
080926A: Introduction to Biomedical Imaging Methods, 1 - 3 op

Applied Computing Technology, Advanced Module: 1. Applied Computing Technology

A452286: Advanced module/Applied computing technology (optional), 25 - 40 op
Optional courses, Choose from the following 35 ECTS cr. Studies that have been completed in the other land can be placed here.
521489S: Research Work on Information Processing, 8 op
812342A: Object Oriented Analysis and Design, 5 op
812341A: Object-Oriented Programming, 5 op
812331A: Interaction Design, 5 op
815657S: Open Source Software Development, 5 op
815305A: Real Time Distributed Software Development, 5 op
817603S: System Design Methods for Information Systems, 5 op
813625S: Information Systems Theory, 5 op
521283S: Big Data Processing and Applications, 5 op
521493S: Computer Graphics, 7 op
521285S: Affective Computing, 5 op
A452285: Advanced module/applied computing technology (obligatory), 10 - 40 op
Obligatory courses
521152S: Applied Computing Project II, 10 op

Applied Computing Technology, Advanced Module: 2. Applied Computing Business

A452287: Advanced module/Applied computing economy (obligatory), 10 - 40 op
Obligatory courses
724206A: Strategic Marketing Management, 5 op
724201A: Internationalization, 5 op
A452288: Advanced module/Applied computing economy (optional), 20 - 40 op
Optional courses, Choose from the following 35 ECTS cr. Studies that have been completed in the other land can be placed here.
806118P: Introduction to Statistics, 5 op
806119P: A Second Course in Statistics, 5 op
521489S: Research Work on Information Processing, 8 op
555314S: Management Information Systems, 5 op
724050A: Bachelor's Thesis in Economics and Business Administration, 10 op
724202A: Managing Multinationals, 5 op
724203A: Financial Statement Analysis, 5 op
724204A: Management Control, 5 op
724207A: Financial Decisions, 5 op
724208A: Portfolio Theory, 5 op
724209A: Monetary Economics, 5 op
724210A: Global Economics, 5 op
724205A: Distribution and Retail Management, 5 op

Advanced Modules: Embedded Systems Electronics

(35 ECTS cr)

Embedded Systems, Advanced Modules: 1. Embedded Systems Electronics

A452281: Advanced Module/Embedded Systems, Embedded Systems Electronics (obligatory), 16 - 21 op
Obligatory courses
521303A: Circuit Theory 2, 5 op
521445S: Digital Techniques 3, 6 op
521281S: Application Specific Signal Processors, 5 op
A452282: Advanced Module/Embedded Systems, Embedded Systems Electronics (optional), 14 - 39 op
Optional courses, Choose from the following 39 ECTS cr. Studies that have been completed in the other land can be placed here.
813621S: Research Methods, 5 op
521405A: Electronic System Design, 5 op
521323S: Wireless Communications I, 5 op
521443S: Electronics Design II, 5 op
521088S: Optoelectronics, 5 op
521489S: Research Work on Information Processing, 8 op
521348S: Statistical Signal Processing, 5 op
521385S: Mobile Telecommunication Systems, 5 op
521304A: Filters, 5 op
521328A: Simulations and Tools for Telecommunications, 5 op

Embedded Systems, Advanced Modules: 2. Embedded Systems Software

A452283: Advanced Module/Embedded Systems, Embedded Systems Software (obligatory), 10 - 20 op
Obligatory courses
521155S: Computer Security, 5 op
521156S: Towards Data Mining, 5 op
521266S: Distributed Systems, 6 op
521260S: Programmable Web Project, 5 op
A452284: Advanced Module/Embedded Systems, Embedded Systems Software (optional), 23 - 35 op
Optional courses, Choose from the following 35 ECTS cr. Studies that have been completed in the other land can be placed here.
813621S: Research Methods, 5 op
812342A: Object Oriented Analysis and Design, 5 op
812341A: Object-Oriented Programming, 5 op
521323S: Wireless Communications I, 5 op
521489S: Research Work on Information Processing, 8 op
521281S: Application Specific Signal Processors, 5 op
521328A: Simulations and Tools for Telecommunications, 5 op

Supplementary module

Choose optional courses so that your degree is the minimun of 120 cr.

Supplementary module can include for example courses from the basic module of another orientation.

Advanced practical training (3 op)

521013A: Advanced Practical Training, 3 op

Master's Thesis (30 op)

The Master's Thesis requires a written maturity test.

521993S: Master's Thesis in Computer Engineering, 30 op
521009S: The Maturity Test for Master`s Degree, 0 op

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

910003S: , 5 op
521012A: Practical Training, 3 op
521019A: Practical training, 5 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

900013Y: Beginners' Finnish Course 1, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900013Y	Beginners' Finnish Course 1 (OPEN UNI)	2.0 op

Proficiency level:
A1.2
Status:
The course is intended for the international students in every faculty of Oulu University.
Required proficiency level:
A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.
ECTS Credits:
3 ECTS credits
Language of instruction:
As much Finnish as possible; English will be used as a help language.
Timing:
-
Learning outcomes:
By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.
Contents:
This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person, expressing opinions, describing people and things, talking about weather and seasons, the names of the months and colours.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, the genitive and partitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.
Mode of delivery:
Contact teaching and guided self study
Learning activities and teaching methods:
Lessons 2 times a week (26 h) and guided self study (50 h)
Target group:
International degree and post-graduate degree students and exchange students of the University
Prerequisites and co-requisites:
Completion of the Survival Finnish Course
Recommended optional programme components:
-
Recommended or required reading:
Gehring, S. & Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)
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 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi. The course will start right after the Survival Finnish course.

521145A: Human-Computer Interaction, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Simo Hosio, Denzil Teixeira Ferreira

Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr
Language of instruction:
In English.
Timing:
Autumn, period 2
Learning outcomes:
1. Knowledge of the Human Computer Interaction (HCI) fundamentals

2. Knowledge of evaluation techniques

3. Knowledge of prototyping techniques

4. Knowledge of how HCI can be incorporated in the software development process
Contents:
Human and computer fundamentals, design and prototyping, evaluation techniques, data collection and analysis.
Mode of delivery:
Face to face teaching.
Learning activities and teaching methods:
Lectures (20 h), exercises (20 h), and practical work (95 h). The course is passed with an approved practical work. The implementation is fully 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 programming and design skills are desired.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. The course involves some basic programming.
Recommended or required reading:
All necessary material will be provided by the instructor.
Assessment methods and criteria:
The assessment is project-based. Students have to complete 4 individual exercises throughout the semester: 1: Using questionnaires; 2: Grouping & clustering; 3: Fitts' law; 4: Advanced evaluation & visualisations. Passing criteria: all 4 exercises must be completed, each receiving more than 50% of the available points.
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:
Denzil Ferreira

Working life cooperation:
-
Other information:
-

521260S: Programmable Web Project, 5 op

Voimassaolo: 01.08.2006 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ivan Sanchez Milara

Opintokohteen kielet: English

Leikkaavuudet:

ay521260S	Programmable Web Project (OPEN UNI)	5.0 op

Status:
The course is mandatory for International Master's Programme in Computer Science and Engineering and Master's Programme in Computer Science and Engineering. It is optional for other degree and master programmes.
ECTS Credits:
5 ECTS cr
Language of instruction:
In English.
Timing:
Spring, periods 3-4.
Learning outcomes:
1. Understands the main design concepts related to REST architectural style and ROA architecture

2. Is able to design, test and implement different components of a RESTful Web API

3. Understands what hypermedia is and how can it be used to build RESTful Web APIs

4. Is able to implement simple clients using Web technologies

5. Becomes familiar with basic technologies to store persitent data on the server and serialize data in the Web
Contents:
RESTful Web APIs, hypermedia, transactional/non-transactional databases , RESTful clients (HTML5 and Javascript).
Mode of delivery:
Web-based teaching and face-to-face teaching.

Learning activities and teaching methods:
Lectures 4 h, guided laboratory work 15 h, the rest as self-study and group work. Each group implements programs and writes a report.
Target group:
M.Sc. level students of Computer Science and Engineering; other students of the university of Oulu are accepted if there is enough space in the classes.
Prerequisites and co-requisites:
Elementary programming. Applied Computing Project I is 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:
Mainly course slides and links to different Web resources announced during the first lecture. Course books: * Leonard Richardson, Mike Amundsen & Sam Ruby. RESTful Web APIs. O'Reilly Media 2013. ISBN: 978-1-4493-5806-8. * Leonard Richardson & Sam Ruby,RESTful Web Services. O'Reilly Media 2007. ISBN: 978-0-596-52926-0.
Assessment methods and criteria:
This course unit utilizes continuous assessment. The project work is divided in different deadlines that students must meet to pass the course. Each deadline will be assessed after completion.
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:
Ivan Sanchez Milara
Working life cooperation:
None.
Other information:
This course replaces the course “521260S Representing structured information”.

813621S: Research Methods, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

Leikkaavuudet:

521146S	Research Methods in Computer Science	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 periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.
Learning outcomes:
Having completed the course, the student is able to explain the general principles of scientific research and the practices of scientific methodology. The student is also able to generate research problems in information processing sciences. The student is able to identify and describe the main research approaches and methods in information processing sciences, and choose the appropriate approach and method for a research problem. The student is also able to evaluate the methodological quality of a research publication. After the course the student is able to choose and apply the proper approach and method for his or her Master’s thesis and find more information on the method from scientific literature.
Contents:
Introduction to general scientific principles, scientific research practices and quality of scientific publications, qualitative research approaches and selected research methods, quantitative research approaches and selected research methods, design science research and selected methods, requirements and examples of Master’s theses, evaluation of research.
Mode of delivery:
Face-to-face teaching, lecture videos
Learning activities and teaching methods:

Lectures 40 h, exercises 30 h and individual work 65 h. Learning diary is written about the lectures and exercises. Exercises include group work.
Target group:
MSc students
Prerequisites and co-requisites:
Completion of Bachelor’s studies
Recommended or required reading:
Lecture slides and specified literature
Assessment methods and criteria:
Accepted learning diary
Grading:
Pass or fail
Person responsible:
Arto Lanamäki

900017Y: Survival Finnish Course, 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: 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 of Oulu University.
Required proficiency level:
No previous Finnish studies.
ECTS Credits:
2 ECTS credits
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:
Multi-modal teaching (Contact teaching, on-line teaching and independent work)
Learning activities and teaching methods:
Lessons 1–2 times a week (12–14 h) and guided self study (36 h)
Target group:
International degree and post-graduate degree students and exchange students 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 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi.

521285S: Affective Computing, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Guoying Zhao

Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr
Language of instruction:
English
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:
After completing the course, student
1. is able to explain the emotion theory and modeling

2. is able to implement algorithms for emotion recognition from visual and audio signals or the fusion of multi-modalities

3. has the ideas of wide applications of affective computing
Contents:
The history and evolution of affective computing; psychological study about emotion theory and modeling; emotion recognition from different modalities: facial expression, speech, EEG; crowdsourcing study; synthesis of emotional behaviors; emotion applications.
Mode of delivery:
Face to face teaching
Learning activities and teaching methods:
The course consists of lectures and exercises. The final grade is based on the points from exam while there are several mandatory exercises.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
A prior programming knowledge, possibly the bachelor level mathematical studies and/or some lower level intermediate studies (e.g. computer engineering or artificial intelligence courses). The recommended optional studies include the advanced level studies e.g. the pattern recognition and neural networks and/or computer vision courses.
Recommended optional programme components:
-

Recommended or required reading:
All necessary material will be provided by the instructor.
Assessment methods and criteria:
The assessment of the course is based on the exam (100%) with mandatory exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Guoying Zhao, Eero Väyrynen, Xiaohua Huang
Working life cooperation:
-
Other information:
-

521281S: Application Specific Signal Processors, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr
Language of instruction:
In English.
Timing:
Autumn, period 1.
Learning outcomes:
After completing the course, student
1. Can distinguish the main types of signal processors

2. Can design basic customized transport triggered architecture processors

3. Is capable of assembling a signal processor out of basic entities

4. Can match the processor performance and the application requirements

5. Applies the TTA codesign environment and Altera's FPGA tools to synthesize a system
Contents:
Examples of modern signal processing applications, main types of signal processors, parallel signal processing, transport triggered architectures, algorithm-architecture matching, TCE design environment and Altera FPGA tools.
Mode of delivery:
Lectures, independent work, group work.
Learning activities and teaching methods:
Lectures 12h (participation mandatory); Instructed labs 12h. Independent work 111h
Target group:
Computer Science and Engineering students + other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those who are specializing into signal processing.
Prerequisites and co-requisites:
521267A Computer Engineering or 521286A Computer Systems (8 ECTS cr) or 521287A Introduction to Computer Systems (5 ECTS cr) and 521337A digital filters, programming 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:
Handouts.
Assessment methods and criteria:
Participation in mandatory classes and approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Teemu Nyländen
Working life cooperation:
No.
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 Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits / 50 hours of work
Language of instruction:
English. Examination can be taken in English or Finnish.
Timing:
The course unit is held in the autumn semester, during period 2. It is recommended to complete the course at the end of studies.
Learning outcomes:
After completing the course, student
1. knows special characteristics of the biosignals and typical signal processing methods
2. can solve small-scale problems related to biosignal analysis
3. implement small-scale software for signal processing algorithms
Contents:
Biomedical signals. Digital filtering. Analysis in time-domain and frequency domain. Nonstationarity. Event detection. Signal characterization.
Mode of delivery:
Face-to-face teaching and guided laboratory work.
Learning activities and teaching methods:
Lectures 10h, Laboratory work 20h, Self-study 20h, written examination.
Target group:
Students interested in biomedical engineering, at their master's level studies.
Students of the University of Oulu.

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:
Laboratory work is supervised by assistants who also check that the task assignments are completed properly. All task assignments are compulsory. The course ends with a written exam.
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.
Other information:

-

521493S: Computer Graphics, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiaopeng Hong, Yingyue Xu, Guoying Zhao

Opintokohteen kielet: English

Leikkaavuudet:

521140S	Computer Graphics	5.0 op

ECTS Credits:
7 ECTS credits
Language of instruction:
In English.
Timing:
Spring, period 4.
Learning outcomes:

Upon completion of the course, the student:
1. is able to specify and design 2D graphics algorithms including: line and circle drawing, polygon filling and clipping
2. is able to specify and design 3D computer graphics algorithms including transformations, viewing, hidden surface removal, shading, texture mapping and hierarchical modeling
3. is able to explain the relationship between the 2D and 3D versions of such algorithms
4. possesses the necessary basic skills to use these basic algorithms available in OpenGL
Contents:
The history and evolution of computer graphics; 2D graphics including: line and circle drawing, polygon filling, clipping, and 3D computer graphics algorithms including viewing transformations, shading, texture mapping and hierarchical modeling; graphics API (OpenGL) for implementation.
Mode of delivery:
Face to face teaching.
Learning activities and teaching methods:
Lectures 30 h / Self-study and programming assignments 104h.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
Programming skills using C++; basic data structures; simple linear algebra. Additionally recommended prerequisite is the completion of the following course prior to enrolling for course unit: 521267A Computer Engineering or 521286A Computer Systems or 521287A Introduction to Computer Systems
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:
1) Textbook: Edward Angel, Dave Shreiner: Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, Addison-Wesley 2015
2) Textbook: Edward Angel: Interactive Computer Graphics, 5th Edition, Addison-Wesley 2008
3) Reference: Peter Shirley, Michael Ashikhmin, Michael Gleicher, et al. : Fundamentals of Computer Graphics, second edition, AK Peters, Ltd. 2005
4) Lecture notes (in English)
5) Materials in the internet (e.g. OpenGL redbook) OpenGL Programming Guide or 'The Red Book': http://unreal.srk.fer.hr/theredbook/ OpenGL Video Tutorial: target=_blank>http://www.videotutorialsrock.com/opengl_tutorial/what_is_opengl/text.php
Assessment methods and criteria:
The assessment of the course is based on the exam (50%) and returned course work (50%).
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5, zero stands for fail.
Person responsible:
Guoying Zhao, Xiaopeng Hong, Yingyue Xu

Working life cooperation:
No
Other information:
-

521321S: Elements of Information Theory and Coding, 5 op

Voimassaolo: 14.11.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Rajatheva Rajatheva, Timo Kokkonen

Opintokohteen kielet: English

Leikkaavuudet:

521323S	Wireless Communications 2	5.0 op

ECTS Credits:
5
Language of instruction:
English.
Timing:
Fall, period 2
Learning outcomes:
1. can use basic methodology of information theory to calculate the capacity bounds of communication and data compression systems.

2. can estimate the feasibility of given design tasks before the execution of the detailed design.

3. understands the operating principles of block codes, cyclic codes and convolutional codes.

4. can form an encoder and decoder for common binary block codes, and is capable of using tables of the codes and shift register when solving problems.

5. can represent the operating idea of a convolutional encoder as a state machine.

6. is able to apply the Viterbi algorithm to decoding of convolutional codes.

7. is capable of specifying principles of Turbo, LDPC and Polar coding and coded modulation.

8. can evaluate error probability of codes and knows practical solutions of codes by name.
Contents:
Entropy, mutual information, data compression, basics of source coding, discrete channels and their capacity, the Gaussian channel and its capacity, rate distortion theory, introduction to network information theory, block codes, cyclic codes, burst error correcting codes, error correcting capability of block codes, convolutional codes, Viterbi algorithm, concatenated codes, and introduction to Turbo, LDPC and Polar coding and to coded modulation.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Face-to-face teaching (lectures and exercises) 64 h and group working.
Target group:
1st year WCE-RAN students and M.Sc. students (i.e., 4th year in EE degree programme)
Prerequisites and co-requisites:
Signal Analysis, Telecommunication Engineering
Recommended optional programme components:
Wireless Communications I and the course support each other. Their simultaneous studying is recommended.
Recommended or required reading:

Parts from books Thomas M. Cover & Joy A. Thomas: Elements of Information Theory, 2nd ed. John Wiley & Sons, 2006 ISBN-13 978-0-471-24195-9, ISBN-10 0-471-24195-4, and S. Benedetto and E. Biglieri: Principles of Digital Transmission with Wireless Applications, 1999, Chapters 3, 10 and in part 11 and 12. Lecture notes and other literature.

Assessment methods and criteria:

The course is passed with weekly exams (only during lecture periods) or with final exam and possible additional course tasks defined in the beginning of the course.

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:

Timo Kokkonen (Coding) / Nandana Rajatheva (Information theory)

Working life cooperation:

No

Other information:

-

031025A: Introduction to Optimization, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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.

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:

-

521289S: Machine Learning, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: 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 cr
Language of instruction:
English. Examination can be taken in English or Finnish.
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 the basics of gradient search method to design a linear discriminant function.

4. can apply regression techniques to practical machine learning problems.
Contents:
Introduction. Bayesian decision theory. Discriminant functions. Parametric and non-parametric classification. Feature extraction. Classifier design. Example classifiers. Statistical regression methods.
Mode of delivery:
Face-to-face teaching, guided laboratory work and independent assignment.
Learning activities and teaching methods:
Lectures 10h, Laboratory work 20h, Self-study 20h, Independent task assignment, written examination.
Target group:
Students who are interested in data analysis technology. Students of the University of Oulu.
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:
Duda RO, Hart PE, Stork DG, Pattern classification, John Wiley & Sons Inc., 2nd edition, 2001. Handouts.
Assessment methods and criteria:
Laboratory work is supervised by assistants who also check that the task assignments are completed properly. The independent task assignment is graded. The course ends with a written exam.
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 weighing the written exam by 2/3 and the task assignment by 1/3.
Person responsible:
Tapio Seppänen
Working life cooperation:

No

Other information:

-

521466S: Machine Vision, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Spring, period 3.

Learning outcomes:

After completing the course, student

1. can utilize common machine vision methods for various image analysis problems

2. can detect and recognize objects using features computed from images

3. can use motion information in image analysis

4. can use model matching in image registration and object recognition

5. can explain the basics of geometric computer vision

6. can calibrate cameras

7. can use stereo imaging for 3D reconstruction

8. can use Matlab for implementing basic machine vision algorithms

Contents:

Course provides an introduction to machine vision, and its applications to practical image analysis problems. Common computer vision methods and algorithms as well as principles of image formation are studied. Topics: 1. Introduction, 2. Imaging and image representation, 3. Color and shading, 4. Image features, 5. Recognition, 6. Texture, 7. Motion from 2D image sequences, 8. Matching in 2D, 9. Perceiving 3D from 2D images, 10. 3D reconstruction.

Mode of delivery:

Face-to-face teaching, homework assignments.

Learning activities and teaching methods:

Lectures (20 h), exercises (16 h) and Matlab homework assignments (16 h).

Target group:

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

Prerequisites and co-requisites:

521467A Digital Image Processing

Recommended optional programme components:

521289S Machine Learning. This courses provide complementary information on machine learning methods applied in machine vision. It is recommended to be studied simultaneously.

Recommended or required reading:

Lecture notes and exercise material. The following books are recommended for further information: 1) Shapiro, L.G., Stockman,G.C.: Computer Vision, Prentice Hall, 2001. 2) R. Szeliski: Computer Vision: Algorithms and Applications, Springer, 2011. 3) D.A. Forsyth & J. Ponce: Computer Vision: A Modern Approach, Prentice Hall, 2002.

Assessment methods and criteria:

The course is passed with final exam and accepted homework assignments.

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:
Janne Heikkilä
Working life cooperation:
No.
Other information:
-

521161S: Multi-Modal Data Fusion, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Abdenour Hadid

Opintokohteen kielet: English

ECTS Credits:
5 ECTS / 135 hours of work
Language of instruction:
English
Timing:
The course is held in the autumn Semester either in Period I or Period II (preferably in Period I).
Learning outcomes:
Upon completion the student should be able to understand the problem of combining data (such as images and audios) of different natures and coming from different sources. The student should be able to implement basic solutions towards the accomplishment of a given task requiring the integration and
combination of data.
Contents:
This course will provide a comprehensive introduction to the concepts and ideas of multi-sensor data fusion. The course will be illustrated with many real-life examples taken from a diverse range of applications. The course will be self-contained as much as possible (no previous knowledge of multisensor
data fusion is assumed). Basic knowledge on related topics like image processing and signal processing will be a plus.
The course will discuss the following topics:
Introduction
Sensors
Architecture
Common Representational Format
Spatial Alignment
Temporal Alignment
Semantic Alignment
Radiometric Normalization
Bayesian Inference
Parameter Estimation
Robust Statistics
Sequential Bayesian Inference
Bayesian Decision Theory
Ensemble Learning
Sensor Management
Mode of delivery:
The course will be based on a combination of lectures (face-to-face teaching), home exercises and a final project.
Learning activities and teaching methods:
Face-to-face teaching: 20 h, home exercises: 80 h, final project: 35h
Target group:
Computer Science and Engineering, Ubiquitous Computing (M.Sc level, study years 4-5).
Prerequisites and co-requisites:
The course will be self-contained as much as possible (no previous knowledge is assumed). Basic knowledge on related topics like image processing and signal processing will be a plus.
Recommended optional programme components:

-

Recommended or required reading:

The course will be based on the following text book: H.B. Mitchell. Data Fusion: Concepts and Ideas. Springer (2012)

Assessment methods and criteria:

To pass the course, the student should retrun the exercices, complete a final programming project and pass an exam. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course will utilize a numercial grading scale 1-5.

Person responsible:

Abdenour Hadid (lecturer), Zinelabidine Boulkenafet (Assistant)

Working life cooperation:

The course includes one or two guest lectures from experts with practical experience.

Other information:

-

521288S: Multiprocessor Programming, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521280S	DSP Laboratory Work	5.0 op

ECTS Credits:

5 ECTS cr / 135 hours of work

Language of instruction:

English

Timing:

Spring semester, periods 3-4

Learning outcomes:

Upon completition of the course, the student:

1. has basic understanding of multiprocessor architectures and heterogeneous computing,
2. has basic understanding on how to design and implement algorithms for heterogeneous platforms,

3. understands the possible challenges and shortcomings related to the current heterogeneous systems,

4. is able to use the OpenCL framework for designing, implementing and optimizing signal processing algorithms for heterogeneous platforms

Contents:

Algorithm design, general purpose computing on graphics processing units, heterogeneous computing, OpenCL programming and optimization

Mode of delivery:

Opening lecture and independent exercise project, which is divided into smaller sub-entities. The exercise project is performed using both desktop and mobile platforms. After each sub-entity, a short seminar is held where the students discuss their results and possible ways to optimize the performance of their implementation.

Learning activities and teaching methods:

Opening lecture (2h), seminars (8h) and independent exercise project (125h).

Target group:

Computer Science and Engineering students and other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those interested in signal processing, processor architectures and embedded systems programming.

Prerequisites and co-requisites:

Matrix Algebra 031078P, Elementary programming 521141P, Computer Systems 521286A, Digital Filters 521337A

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:

Students complete the course exercises after the attending to the opening lecture in groups of two students. Assessment is based on the quality of the completed exercises and exercise reports. More detailed information on assessment will be announced at the beginning of the course.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Teemu Nyländen
Working life cooperation:
-
Other information:
-

521279S: Signal Processing Systems, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Olli Silven

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS cr
Language of instruction:
English
Timing:
Autumn, period 2
Learning outcomes:
1. Student can explain the challenges of signal processing hardware, software, and design methodologies.

2. Student is able to transform a digital filter designed with floating point arithmetic into a fixed point precision implementation, optimizing the word lengths to achieve the performance specifications.

3. Student is able to explain the most important algorithm implementation structures and can identify their usage contexts.

4. Student has rudimentary practical skills in modeling, designing, and judging finite word length signal processing algorithms with Matlab and Simulink software tools.
Contents:
Binary and floating point arithmetic, DSP programming models and co-design, digital signal processors, algorithms and implementations, including CORDIC, transforms (FFT and DCT), multi-rate signal processing, polyphase filters, filter banks, adaptive algorithms and applications. The software environments of the course are Matlab with the Fixed Point Toolbox extension and Simulink with the DSP Blockset extension.
Mode of delivery:
Lectures, independent work, group work.
Learning activities and teaching methods:
The course consists of lectures (30 h) and design exercises (6-12 h). the rest as independent work (33h).
Target group:
Computer Science and Engineering students: This is an advanced-level course intended for masters-level students, especially to those that are specializing into signal processing. + Other Students of the University of Oulu.
Prerequisites and co-requisites:
521337A Digital Filters, 521267A Computer Engineering or 521286A Computer Systems, 8 ECTS cr or 521287A Introduction to Computer Systems, 5 ECTS cr
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 materials. Material is in English.
Assessment methods and criteria:
Final exam and approved design 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:
Olli Silven
Working life cooperation:
None.
Other information:
-

521348S: Statistical Signal Processing, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

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 autumn semester of the master studies.
Learning outcomes:
Upon completion the student will

1. understand the key concepts in estimation theory such as the classical and Bayesian framework.
2. masters the most important estimation principles such as minimum variance, maximum likelihood, least squares and minimum mean square error estimators.
3. can derive an estimator for a given criterion and basic data models.
4. can use the methodology of estimation theory to analyze the performance of estimators
5. can choose a proper estimator for a given purpose
6. understands the basics of detection and classification theory: hypothesis testing, receiver operating characteristics (ROC), matched filtering, estimator-correlator

Contents:
Estimation theory, minimum variance unbiased estimator, Cramer-Rao lower bound, linear models, general minimum variance unbiased estimation, best linear unbiased estimators, maximum likelihood estimation, leas squares estimation, Bayesian estimation, linear Bayesian estimation, Kalman filters, statistical decision theory, receiver operating characteristics, hypothesis testing, matched filter, estimator-correlator.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Face-face-teaching (lectures and exercises) 50h, Matlab simulation exercises in groups 30 h, independent work 50 h.
Target group:
Electrical, communications, computer and system engineering as well as mathematics, physics and computer science students with knowledge of statistics in master or senior undergraduate level.
Prerequisites and co-requisites:
The required prerequisite is the completion of the following courses prior to enrolling for the course: 031080A Signal analysis, 031021P Statistics, 031078P Matrix algebra
Recommended optional programme components:
-
Recommended or required reading:
Parts from books Kay, Steven M. "Fundamentals of statistical signal processing, volume I: estimation theory." (1993), Kay, Steven M. "Fundamentals of statistical signal processing: Detection theory, vol. 2." (1998), Van Trees, Harry L. Detection, estimation, and modulation theory. John Wiley & Sons, 2004.

Assessment methods and criteria:
Continuous evaluation by solving homework problems, successful completion of simulation projects, a final exam.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero (0) stands for a fail.
Person responsible:
Markku Juntti
Working life cooperation:
-
Other information:
-

521156S: Towards Data Mining, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Tamminen, Heli Koskimäki

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits
Language of instruction:
Finnish or English
Timing:
Autumn, period I.
Learning outcomes:
Student can recognize the type of the data before further analysis and the required preprocessing. The concrete learning outcomes are:

1. Student can design and implement the data gathering
2. Student can combine data from different sources
3. Student can normalize and transfor data, and handle missing or incorrect data.
4. Student can ensure the 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:
16h lectures, 16h 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:
Participation in mandatory classes and 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 and Koskimäki Heli
Working life cooperation:
-
Other information:
-

812650S: Advanced Topics in Human-Centred Design, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Dorina Rajanen

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. Master's students can take this course either on the 1st or the 2nd year.

Learning outcomes:
After completing the course, students are familiar with some state-of-the-art research results related to current themes and contexts in human-centred design, they understand the strengths and limitations of various methods and frameworks used in human-centred design and they can acquire knowledge and critically read relevant research articles on human-centred design research topics.

Contents:
The content of the course will change with time. The initial set of current themes include: User experience as an object of analysis and design, Participatory design, end-user-design and living labs, Information ecologies and infrastructures, Design for all, Iterative and incremental design and development, The impact of human-centred design, Current development contexts such as: Open source software development, Game development, Development of ICT for children, Ubiquitous computing

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 20 h, assignments 107 h, seminars 6 h

Target group:
MSc students
Prerequisites and co-requisites:
Course “812335A Interaction Design” or similar knowledge.

Recommended optional programme components:

Recommended or required reading:
Selected scientific articles
Assessment methods and criteria:
Assignments

Grading:
Numerical scale 1-5 or fail
Person responsible:
Mikko Rajanen
Working life cooperation:
No

521151A: Applied Computing Project I, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

521041A	Applied Computing Project I	8.0 op

ECTS Credits:
10 ECTS cr
Language of instruction:
In English.
Timing:
Autumn and spring, periods 1-4.
Learning outcomes:
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:
Project work that is typically executed in groups of 3-5 students. Note: the project work cannot be done alone.
Mode of delivery:
3-4 lectures to introduce and conclude the course and project works, collaborative project work for a "client" (teaching assistants and/or industry representatives)
Learning activities and teaching methods:
Practical work in project teams. The course is passed with an approved project work. The implementation is fully in English.
Target group:
3rd year Computer Science and Engineering B.Sc. students and other Students of the University of Oulu.
Prerequisites and co-requisites:
While no specific courses are not required, elementary programming and design skills are desired.
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:
For additional reading (not mandatory): Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).
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.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Matti Pouke, Denzil Ferreira
Working life cooperation:
No
Other information:
-

521152S: Applied Computing Project II, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:
10 ECTS cr
Language of instruction:
English.
Timing:
Autumn and Spring, periods 1-4.
Learning outcomes:
1. has advanced understanding on how to collaboratively design a medium-scale software project,

2. has advanced understanding on how to implement and evaluate a medium-scale software project,

3. is able to extensively document a medium-scale software project,

4. has advanced skills in presenting and pitching a project work, i.e. give a good, concise presentation of the work,
Contents:
Project work that is typically executed in groups of 3-5 students. Note: the project work cannot be done alone.
Mode of delivery:
3-4 lectures to introduce and conclude the course and project works, collaborative project work for a "client" (teaching assistants and/or industry representatives).
Learning activities and teaching methods:
Practical work in project teams. The course is passed with an approved project work. The implementation is fully in English.
Target group:
Computer Science and Engineering MSc students and other Students of the University of Oulu.
Prerequisites and co-requisites:
While no specific courses are not required, programming and design skills are desired.
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:
For additional reading (not mandatory): Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).
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:
Matti Pouke, Denzil Ferreira
Working life cooperation:
No
Other information:
-

521283S: Big Data Processing and Applications, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ekaterina Gilman

Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr
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 fundatmenals, data storage, batch and stream data processing, data analysis, privacy and security, big data use cases.
Mode of delivery:
Face-to-face teaching, 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, the exercises do not require programming skills but they are an advantage.
Recommended optional programme components:
Finishing 521290S Distributed Systems, 521497S Pattern recognition and neural networks, and 521286A Computer Systems is beneficial.
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 exercises, seminar presentations and short reports on a selected topic (group work), and answering two quizzes during the course. To pass the course, it is enough to get 50% of available points for each part. No exam.

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

Person responsible:
Ekaterina Gilman

Working life cooperation:
The course includes also invited lectures from industry.
Other information:
-

521290S: Distributed Systems, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiang Su

Opintokohteen kielet: Finnish

Leikkaavuudet:

521266S-01 Distributed Systems, Exam 0.0 op
521266S-02 Distributed Systems, Exercise Work 0.0 op
521266S Distributed Systems 6.0 op

ECTS Credits:
5 ECTS cr
Language of instruction:
In English.
Timing:
Spring, period 3.
Learning outcomes:
After completing the course, the student
1. is able to explain the key principles of distributed systems
2. apply the principles in evaluating major design paradigms used in implementing distributed systems
3. solve distributed systems related problems
4. design and implement a small distributed system
Contents:
Introduction, architectures, processes, communication, naming, synchronization, consistency and replication, fault tolerance, security, case studies.
Mode of delivery:
Face-to-face.
Learning activities and teaching methods:
Lectures 22 h, exercises 16 h, project work 50 h, self-study 47 h.
Target group:
M.Sc. students (computer science and engineering) and other Students of the University of Oulu
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:
Required literature: Maarten van Steen and Andrew S. Tanenbaum, Distributed Systems – Principles and Paradigms, Third Edition, 2017.
Assessment methods and criteria:

The course uses continuous assessment so that there are 2 intermediate exams. Alternatively, the course can also be passed with a final exam. The course includes a mandatory project work.

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

Grading:
Numerical scale 1-5; zero stands for a fail.
Person responsible:
Professor Timo Ojala
Working life cooperation:
None.
Other information:
-

812331A: Interaction Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Netta Iivari

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 1. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:

Objective: The course explains the role of human interaction with IT products, systems, and services, explains the factors and problems related to it to motivate interaction design, and teaches some user-centered methods for analysis, evaluation and design of interactions.

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:

Face-to-face teaching, self-study

Learning activities and teaching methods:

Lectures 20 h, exercises and seminar 25 h, individual and group assignments 90 h; or self-study: an opening lecture 2 h, one larger
assignment 110 h and individual tasks 21 h.

Target group:

MSc students

Prerequisites and co-requisites:

Basic knowledge on human-computer interaction with usability and user-centered design.

Recommended or required reading:

Sharp et al. (2015) Interaction Design, chapters 1-2, 4-5, 7-13 (pages 1-64, 100-157, 226-473)

Assessment methods and criteria:

Accepted assignments.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Netta Iivari

Working life cooperation:

Invited lectures, assignments

Other information:

The course book will be available in electronic format that would be very useful, as the book is updated regularly and we are using a very old
version.

521147S: Mobile and Social Computing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Denzil Teixeira Ferreira

Opintokohteen kielet: Finnish

Leikkaavuudet:

521046A	Mobile Computing	5.0 op
521045S	Mobile Computing	5.0 op

Proficiency level:
English B2 - C2

ECTS Credits:
5 ECTS cr
Language of instruction:
In English.
Timing:
Spring, periods 3-4
Learning outcomes:
1. Ability to implement mobile user interfaces

2. Ability to implement online social network applications

3. Ability to explain the fundamental concepts of context awareness

4. Ability to explain the fundamental concepts of online communities
Contents:
Mobile interface design and implementation, mobile sensor acquisition, context awareness, social platforms, crowdsourcing, online communities, graph theory.
Mode of delivery:
Face to face teaching + independent work.
Learning activities and teaching methods:
Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
Object oriented 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:
All necessary material will be provided by the instructor.
Assessment methods and criteria:
The assessment is project-based. Students have to complete individual assignments throughout the semester and a final pair-based project: build a mobile application, conduct or analysis of data. Passing criteria: the assignments and the project must be must be completed, receiving more than 50% of the available points.
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:
Denzil Ferreira
Working life cooperation:
None.
Other information:
-

521158S: Natural Language Processing and Text Mining, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: 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 1. It is recommended to complete the course at the end of period 1
Learning outcomes:
Upon completing the course, the student is expected to i) comprehend, design and implement basic (online) text retrieval and query systems; ii) account for linguistic aspects and perform word sense disambiguation; iii) perform basic (statistical) inferences using corpus; iv) manipulate (statistical) language modelling toolkits, online lexical databases and various natural language processing tools.
Contents:
Foundation of text retrieval systems, Lexical ontologies, word sense disambiguation, Text categorization, Corpus-based inferences and Natural Language Processing tools
Mode of delivery:
Face- to-face teaching and laboratory sessions
Learning activities and teaching methods:
Lectures (24 h), tutorial/laboratory sessions (10h), 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 to advanced) programming skills in Python
Prerequisites and co-requisites:
Programming skills (preferably) in Python

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:
Introduction to Information Retrieval, by C. Manning, P. Raghavan, and H. Schütze. Cambridge University Press, 2008. (Free from http://nlp.stanford.edu/IR-book/) Foundations of statistical natural language processing, by Manning, Christopher D., Schütze, Hinrich. Cambridge, Mass.: MIT Press, 2000
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:
-

521148S: Ubiquitous Computing Fundamentals, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Kukka

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS cr
Language of instruction:
In English.
Timing:
Autumn, periods 1-2.
Learning outcomes:
1. has gained a good overview of the history and current state of ubiquitous computing

2. has learned to design, implement, and evaluate a ubiquitous computing system

3. has learned how to carry out a research project, from initial research problem formulation to concept development, and further to in-the-wild evaluation and reporting using an academic format

Contents:
Ubiquitous computing systems, privacy, field studies, ethnography, interfaces, location, context-aware computing, processing sequential sensor data.
Mode of delivery:
Lectures, group project
Learning activities and teaching methods:
Lectures 20 h, exercises 22 h, project work 50 h, self-study 43 h. Exercises and project work are completed as group work.
Target group:
M.Sc. students (computer science and engineering) and other Students of the University of Oulu.
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:
Required literature: John Krumm (editor) Ubiquitous Computing Fundamentals, Chapman & Hall, 2010, ISBN 978-1-4200-9360-5, 328 pages; selected scientific publications.
Assessment methods and criteria:
The course is graded based on the following criteria: - Attendance - Summaries of selected scientific publications - Interim reports during project work - Final project report.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical scale 1-5; zero stands for a fail.
Person responsible:
Adjunct Professor Hannu Kukka
Working life cooperation:
The course teaches students how to design, implement, and evaluate an academic research project. Especially helpful to those students planning post-graduate studies.
Other information:
-

A452291: Computer Vision and Signal Processing, advanced module, optionals, 10 - 20 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

optionals

521495A: Artificial Intelligence, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Abdenour Hadid

Opintokohteen kielet: English

Leikkaavuudet:

ay521495A	Artificial Intellig (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Period 3.

Learning outcomes:

1. is able to identify the types of problems that can be solved using methods of artificial intelligence.
2. knows the basic concepts of intelligent agents, the common search methods used in artificial intelligence, logic based reasoning and applying planning techniques to problems of artificial intelligence.
3. can also apply simple methods to reasoning under uncertainty and machine learning from observation.
4. In addition the student will be able to implement the most common search methods.

Contents:

1) Introduction, 2) Rational (Intelligent) Agents and Uninformed Search, 3) Informed Search, 4) Programming Project 1 (Pacman 1), 5) Adversarial Search (Games), 6) Programming Project 2 (Pacman 2), 7) Uncertainty and Utilities, 8) Markov Decision Processes, 9) Reinforcement Learning, 10) Bayesian Networks, 11) Machine Learning (learning from Observation), 12) Advanced Applications, 13) Conclusions

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

24 hours of lectures and a programming exercise (approximately 25 hours) during period 3, the rest as independent work.

Target group:

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

Prerequisites and co-requisites:

Programming 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:

The course material is based on the Artificial Intelligence course of Berkely University and the book "Artificial Intelligence, A Modern Approach" by Russell & Norvig.
1) http://ai.berkely.edu
2) Russell S., Norvig P.: Artificial Intelligence, A Modern Approach, Second Edition, Prentice Hall, 2003.

Assessment methods and criteria:

The course is passed with a final exam and a passed programming exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 / fail.

Person responsible:

Abdenour Hadid
Zinelabidine Boulkenafet

Working life cooperation:

-

Other information:

-

521337A: Digital Filters, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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:

1. Sampling theorem, aliasing and imaging, 2. Discrete Fourier transform, 3. Z-transform and frequency response, 4. Correlation and convolution, 5. Digital filter design, 6. FIR filter design and realizations, 7. IIR filter design and realizations, 8. Finite word length effects and analysis, 9. Multi-rate signal processing.

Mode of delivery:

Face-to-face teaching (Lectures), independent work, group work

Learning activities and teaching methods:

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:

Lecture notes and exercise materials. Material is in Finnish and in English. Course book: Ifeachor, E., Jervis, B.: Digital Signal Processing, A Practical Approach, Second Edition, Prentice Hall, 2002.

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:

-

521348S: Statistical Signal Processing, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

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 autumn semester of the master studies.

Learning outcomes:

Upon completion the student will

1. understand the key concepts in estimation theory such as the classical and Bayesian framework.
2. masters the most important estimation principles such as minimum variance, maximum likelihood, least squares and minimum mean square error estimators.
3. can derive an estimator for a given criterion and basic data models.
4. can use the methodology of estimation theory to analyze the performance of estimators
5. can choose a proper estimator for a given purpose
6. understands the basics of detection and classification theory: hypothesis testing, receiver operating characteristics (ROC), matched filtering, estimator-correlator

Contents:

Estimation theory, minimum variance unbiased estimator, Cramer-Rao lower bound, linear models, general minimum variance unbiased estimation, best linear unbiased estimators, maximum likelihood estimation, leas squares estimation, Bayesian estimation, linear Bayesian estimation, Kalman filters, statistical decision theory, receiver operating characteristics, hypothesis testing, matched filter, estimator-correlator.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-face-teaching (lectures and exercises) 50h, Matlab simulation exercises in groups 30 h, independent work 50 h.

Target group:

Electrical, communications, computer and system engineering as well as mathematics, physics and computer science students with knowledge of statistics in master or senior undergraduate level.

Prerequisites and co-requisites:

The required prerequisite is the completion of the following courses prior to enrolling for the course: 031080A Signal analysis, 031021P Statistics, 031078P Matrix algebra

Recommended optional programme components:

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Recommended or required reading:

Parts from books Kay, Steven M. "Fundamentals of statistical signal processing, volume I: estimation theory." (1993), Kay, Steven M. "Fundamentals of statistical signal processing: Detection theory, vol. 2." (1998), Van Trees, Harry L. Detection, estimation, and modulation theory. John Wiley & Sons, 2004.

Assessment methods and criteria:

Continuous evaluation by solving homework problems, successful completion of simulation projects, a final exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero (0) stands for a fail.

Person responsible:

Markku Juntti

Working life cooperation:

-

Other information:

-

521147S: Mobile and Social Computing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Denzil Teixeira Ferreira

Opintokohteen kielet: Finnish

Leikkaavuudet:

521046A	Mobile Computing	5.0 op
521045S	Mobile Computing	5.0 op

Proficiency level:

English B2 - C2

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Spring, periods 3-4

Learning outcomes:

1. Ability to implement mobile user interfaces

2. Ability to implement online social network applications

3. Ability to explain the fundamental concepts of context awareness

4. Ability to explain the fundamental concepts of online communities

Contents:

Mobile interface design and implementation, mobile sensor acquisition, context awareness, social platforms, crowdsourcing, online communities, graph theory.

Mode of delivery:

Face to face teaching + independent work.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

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

Prerequisites and co-requisites:

Object oriented 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:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete individual assignments throughout the semester and a final pair-based project: build a mobile application, conduct or analysis of data. Passing criteria: the assignments and the project must be must be completed, receiving more than 50% of the available points.
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:

Denzil Ferreira

Working life cooperation:

None.

Other information:

-

521467A: Digital Image Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay521467A	Digital Image Processing (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

Lectures in Finnish and exercises in English. Course can be passed in Finnish and English.

Timing:

Autumn, period 1.

Learning outcomes:

Upon completion of the course the student:
- understands the basic theory of digital image processing and knows its main applications,
- is able to apply spatial and frequency domain and wavelet based methods in image enhancement, restoration, compression and segmentation.

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Contents:

1. Fundamentals of digital images, 2. Image enhancement in spatial and frequency domains, 3.Image restoration, 4. Color image processing, 5. Wavelets, 6. Image compression, 7. Morphological image processing and 8. Image segmentation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 24 h, exercises 14 h and homework assignments 30 h. The rest is independent work.

Target group:

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

Prerequisites and co-requisites:

None.

Recommended optional programme components:

In order to obtain deep understanding of the content, it is a benefit if the student has completed the mathematics courses in the computer science and engineering BSc program or otherwise has equivalent knowledge.

Recommended or required reading:

Gonzalez, R.C., Woods, R.E.: Digital Image Processing, Third Edition, Prentice-Hall, 2008, Chapters 1-10. Lecture notes and exercise

Assessment methods and criteria:

The course is completed by passing the exam and homework assignments.
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:

Janne Heikkilä

Working life cooperation:

None.

Other information:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
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:

Professor Timo Ojala.

Working life cooperation:

-

521148S: Ubiquitous Computing Fundamentals, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannu Kukka
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Autumn, periods 1-2.

Learning outcomes:

1. has gained a good overview of the history and current state of ubiquitous computing

2. has learned to design, implement, and evaluate a ubiquitous computing system

3. has learned how to carry out a research project, from initial research problem formulation to concept development, and further to in-the-wild evaluation and reporting using an academic format

Contents:

Ubiquitous computing systems, privacy, field studies, ethnography, interfaces, location, context-aware computing, processing sequential sensor data.

Mode of delivery:

Lectures, group project

Learning activities and teaching methods:

Lectures 20 h, exercises 22 h, project work 50 h, self-study 43 h. Exercises and project work are completed as group work.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu.

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:

Required literature: John Krumm (editor) Ubiquitous Computing Fundamentals, Chapman & Hall, 2010, ISBN 978-1-4200-9360-5, 328 pages; selected scientific publications.

Assessment methods and criteria:

The course is graded based on the following criteria: - Attendance - Summaries of selected scientific publications - Interim reports during project work - Final project report.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Adjunct Professor Hannu Kukka

Working life cooperation:

The course teaches students how to design, implement, and evaluate an academic research project. Especially helpful to those students planning post-graduate studies.

Other information:

-

521283S: Big Data Processing and Applications, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ekaterina Gilman

Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

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 fundatmenals, data storage, batch and stream data processing, data analysis, privacy and security, big data use cases.

Mode of delivery:

Face-to-face teaching, 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, the exercises do not require programming skills but they are an advantage.

Recommended optional programme components:

Finishing 521290S Distributed Systems, 521497S Pattern recognition and neural networks, and 521286A Computer Systems is beneficial.

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 exercises, seminar presentations and short reports on a selected topic (group work), and answering two quizzes during the course. To pass the course, it is enough to get 50% of available points for each part. No exam.

Grading:

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

Person responsible:

Ekaterina Gilman

Working life cooperation:

The course includes also invited lectures from industry.

Other information:

-

A452292: Ubiquitous Computing, advanced module, optionals, 17 - 20 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

optionals

521479S: Software Project, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Christian Wieser

Opintokohteen kielet: English

ECTS Credits:

7

Language of instruction:

Finnish/English, material available in English.

Timing:

Autumn, periods 1-2.

Learning outcomes:

After completing the course, students have demonstrated their capabilities to design, develop and test real-life software. Further, they have shown their proficiency in professionally documenting their work during the assignment.

Contents:

Phases of software engineering process: requirement gathering, analysis, design, implementation, testing, (maintenance). Project-work, starting a project, project management, working with external parties, project documentation. Project related implementation techniques and tools, software documentation.

Mode of delivery:

Face-to-face and independent studies.

Learning activities and teaching methods:

Working methods: The course is done in groups of 3-4 students. The clients are typically various companies and societies. Project progress is supervised in formal reviews, where the project teams present their work as it reaches the milestones: the software requirement specification, the project plan, the software design specification, an operational prototype demonstration, the test documentation, and finally the functional software demonstration and release. In addition to formal reviews the project work is coordinated with steering group meetings. The work environment and development tools vary between projects. The number of students that can attend the course is limited. Lectures 10 h, design project in period 4-6 180 h.

Target group:

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

Prerequisites and co-requisites:

521457A Software Engineering, 521453A Operating Systems, 521141P Elementary Programming, 521286A Computer Systems or 521142A Embedded Systems Programming and varying project related background reading.

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:

Pressman, R.S.: Software Engineering A Practitioner's Approach, 4th edition, Mc Graw-Hill, 1997; Phillips, D.: The Software Project Manager's Handbook, IEEE Computer Society, 2000; Project documentation; project related manuals and handbooks.

Assessment methods and criteria:

Project work and documentation.
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:

Christian Wieser

Working life cooperation:

-

Other information:

-

521149S: Special Course in Information Technology, 5 - 8 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Ojala, Timo Kullervo
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5-8

Language of instruction:

English or Finnish

Timing:

Autumn and Spring, periods 1-4.

Learning outcomes:

The learning outcomes are defined based on the course topic.

Contents:

Varies yearly.

Mode of delivery:

Face-to-face teaching, also web-based teaching can be used.

Learning activities and teaching methods:

Lectures, exercises, design exercise, project work and seminars depending on the topic of the year. The implementation of the course will be informed separately. The course can be given several times with different contents during the academic year and it can be included into the degree several times.

Target group:

M.Sc. level students of Computer Science and Engineering; other students are accepted if there is space in the classes.

Prerequisites and co-requisites:

Will be defined based on the contents.

Recommended optional programme components:

No.

Recommended or required reading:

Will be announced at the first lecture

Assessment methods and criteria:

Depends on the working methods.
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:

Professor of CSE

Working life cooperation:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
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:

Professor Timo Ojala.

Working life cooperation:

-

521154S: UBISS - International UBI Summer School, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Ojala, Timo Kullervo
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

English.

Timing:

Summer semester (June).

Learning outcomes:

Objective: Summer School provides students with hands on experience and insight on selected topics on the multidisciplinary fields of human-computer interaction, ubiquitous computing and urban informatics. A Summer School comprises of multiple parallel workshops that each have their specific topic and contents.
Learning outcomes: Defined based on the workshop topic.

Contents:

Varies yearly.

Mode of delivery:

Face-to-face teaching in workshops.

Learning activities and teaching methods:

Lectures, a project completed as group work, self-study.

Target group:

Computer Science and Engineering, MSc. level students.

Prerequisites and co-requisites:

Defined based on the workshop topic.

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 package that is selected based on the workshop topic.

Assessment methods and criteria:

Written exam (50%), project (50%).

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Timo Ojala

Working life cooperation:

No.

815657S: Open Source Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

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 periods 1 and 2.It is recommended to complete the course in the 1st autumn semester.

Learning outcomes:

After passing the course, a student will be able to - define the historical background and the ideology of Open Source Software (OSS), - participate in an OSS development project, - evaluate the impact of the usage of OSS and OSS licenses on software development and exploitation, and - view the phenomenon through the essential scientific research.

Contents:

The course introduces OSS development paradigm and current topics in OSS research. OSS affects both the way to produce software and the decisions of user organizations. It can be understood, for example, from different social, legal, economical, software engineering and data security viewpoints. The aim is to study from different perspectives, for example, what OSS is and what it is not, the history and organisation of OSS projects, methods of OSS development and usage, as well as licensing models and possible risks. The emphasis is on research work.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures and seminars about 40 h, exercises and peer reviews about 20 h, seminar article and presentation about 70 h

Target group:

MSc students

Prerequisites and co-requisites:

Compulsory prerequisites are Bachelor degree or other equivalent degree and basic knowledge on software engineering and research work.

Recommended or required reading:

Fogel, K. (2005): Producing Open Source Software - How to Run a Successful Free Software Project, O'Reilly Media; Rosen L. (2004): Open Source Licensing: Software Freedom and Intellectual Property Law, Prentice Hall; scientific articles covering the topic.

Assessment methods and criteria:

Active participation, seminar article and other assignments

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Henrik Hedberg

815305A: Real Time Distributed Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Pulli

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 133 hours of work.

Timing:

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

Learning outcomes:

After completing the course, the student is able to analyse the characteristics of real-time distributed systems; is able to acquire an object-oriented, model-based approach to solve the design problems found in real-time systems; is able to detect and derive specific problems facing the real-time software designer, and to suggest design patterns to solve those problems.

Contents:

Introduction 1. Characteristics of real-time systems; 2. Resource management; 3. Safety and reliability; 4. Time constraints; 5. Concurrency; 6.
Scheduling; 7. Interrupts Characteristics of Distribution 1. Distribution architectures 2. Concept of time; 3. Synchronisation; 4. Latency and
jitter; 5. Quality of service; 6. Service discovery; 7. Networking primitives Real-Time UML Modelling Methodology Real-Time Design Patterns Design
Examples: Embedded, Ubiquitous, Mobile, Web/Internet.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h, design exercises 15 h, student project 80 h.

Target group:

MSc students

Prerequisites and co-requisites:

Computer architecture, object-oriented analysis and design (UML), programming language C and/or Java.

Recommended or required reading:

Lecture notes. Course book: Douglass B.P. (2009) Real-Time Design Patterns – Robust Scalable Architecture for Real-Time Systems. Addison-
Wesley ISBN 0-201-69956-7. 500 p.

Assessment methods and criteria:

Exam and project evaluation

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Petri Pulli

Working life cooperation:

One or two industrial guest lecturers

817603S: System Design Methods for Information Systems, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail
Opettajat: Pasi Karppinen
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 1.

Learning outcomes:

After the course the student understands the complexity of business, organizational, technical, and human aspects that affect ISD and the selection of methods in ISD. The student also understands the defects of traditional waterfall model and how other methods aim to answer to these defects and to other challenges in ISD. In particular, with socio-technical methods (e.g., SSM, ETHICS) and their techniques the student is able to re-plan and develop the sub-systems (automated and non-automated) of organization into a coherent whole and to take into account job satisfaction issues in addition to efficiency demands in ISD and in planning workflows in organization. The student is also able to assess and give arguments which method is suitable for an ISD project in an organization.

Contents:

After the course, the student understands the complexity of business, organizational, technical, and human aspects that affect ISD and the
selection of methods in ISD. The student also understands the defects of traditional waterfall model and how other methods aim to answer to the
defects of it and also answer to other challenges in ISD. In particular, with socio-technical methods (e.g., SSM, ETHICS) and their techniques, students are able to re-plan and develop the sub-systems (automated and non-automated) of organization into a coherent whole and to take into account job satisfaction issues in addition to efficiency demands in ISD and in planning workflows in organization. The student is also able to assess and give arguments on which method is suitable for an ISD project in an organization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 20 h, exercises 18 h, homework 36 h, essay 26 h, examination 34 h

Target group:

MSc students

Prerequisites and co-requisites:

Bachelor studies recommended

Recommended optional programme components:

Recommended or required reading:

Avison, D., Fitzgerald, G. (2006) Information Systems Development, methodologies, techniques & tools. Fourth Edition. London: McGraw-Hill.
Research articles (to be announced during the course implementation).

Assessment methods and criteria:

Exercises, assignments, essay, and examination.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Pasi Karppinen

Working life cooperation:

No

813625S: Information Systems Theory, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Dorina Rajanen

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 periods 1 and 2. It is recommended to complete the course at the 2nd autumn semester.

Learning outcomes:

After completing the course, students will have a good knowledge and understanding of a broad array of research topics and themes within the field of information systems; will have good knowledge and understanding of information systems research and the process by which that research is produced; will have competence in critiquing research articles published in some of the leading academic journals and conference proceedings; will have competence in critical thinking, and analysis and synthesis of academic sources; will have competence in verbally presenting arguments in an academic fashion; will know how to write a literature review on an information systems research topic.

Contents:

Information Systems Research Overview, A contemporary selection of Information Systems research themes.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 24 h, seminars 10 h, individual and group assignments 100 h; or self-study: opening lecture 2 h, assignments 132 h.

Target group:

MSc students

Prerequisites and co-requisites:

Bachelor's degree or similar, Research Methods course. Recommended to take before Master's Thesis.

Recommended optional programme components:

Recommended or required reading:

Lectures and Selection of scientific articles

Assessment methods and criteria:

Accepted assignments

Grading:

Numerical scale 1-5 or fail

Person responsible:

Dorina Rajanen

Working life cooperation:

No

Other information:

Course material can be found at OPTIMA e-learning environment, Urkund is used for course work submissions.

521423S: Embedded System Project, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Röning

Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

Lecturing in Finnish, material available in English

Timing:

Spring, periods 3-4.

Learning outcomes:

1. After passing the course a student can explain the life cycle of the embedded system, the characteristic features related to embedded systems development, and the risks involved.
2. In addition, the student can explain the roles of the client and the system developer during the requirements specification, and the role of the iteration phase as a part of the requirements specification phase. The student can explain the factors affecting to SW/HW partitioning process, and the concept of SW /HW dualism. The student can fairly analyze the factors affecting to the selection of the processor and the operating system. The student can recognize the basic development tools used and their possible advantages and disadvantages.
3. The student can compare various testing approaches. The student can explain how a design error affects to the final cost of the system in different phases of the development. The student can do some basic I/O programming using C programming language.

Contents:

The embedded design life cycle, the selection process, the partitioning decision, the development environment, the special software techniques, a basic toolset, JTAG/ICE, testing, I/O programming.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

The course is run in a project work in groups of two and follow up the progress reporting meetings. Lectures 20 h, laboratory exercise in period 1-3 120 h.

Target group:

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

Prerequisites and co-requisites:

521412A Digital Techniques I
Also recommended 521275A Embedded Software Project, 521432A Electronics Design I.

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:

Berger, Arnold S. (2002) Embedded Systems Design: An introduction to Processes, Tools, & Techniques, CMP Books, USA. ISBN:1578200733.

Assessment methods and criteria:

Project work.
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:

None.

Other information:

-

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:

After completing 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 and face-to-face teaching.

Learning activities and teaching methods:

Lectures (36h), course exercises (10-20h), 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 electrical 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:
Bryant & O'Hallaron, Computer Systems: A Programmer's Perspective, 3rd Edition, Chapters 1-9.
Patterson & Hennessy, Computer Organization and Design: The Hardware/Software Interface, 5th Edition, Chapters 1-2, 4-5.

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.
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:

Teemu Leppänen

Working life cooperation:

Visiting lectures with experts from local industry are possible.

Other information:

-

521275A: Embedded Software Project, 8 op

Voimassaolo: 01.08.2007 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Teemu Tokola

Opintokohteen kielet: English

ECTS Credits:

8

Language of instruction:

Material in English, lectures and guidance of individual groups available in English.

Timing:

Spring, periods 3-4.

Learning outcomes:

1. Can work independently on a non-trivial problem

2. Knows how to write a thesis and has gained lot of experience on refining text

3. Can make a scientific background study on a topic

4. Has increased experience on implementing an embedded software

5. Has improved group work and project skills

Contents:

This course familairizes the student with modern embedded system development with modern methods and tools. Topics: Development tools, practical application program for an embedded system. The students additionally work on the application topic through scientific papers and use their application program to produce a scientific work of their own.

Mode of delivery:

Face-to-face teaching, independent project work in groups.

Learning activities and teaching methods:

Pair project with monitoring meetings and a compulsory exercise. Lectures 30 h, design exercise in period 4-6 180 h.

Target group:

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

Prerequisites and co-requisites:

521457A Software Engineering, 521286A Computer Systems or 521142A Embedded Systems Programming. In addition, 521453A Operating Systems be beneficial.

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:

Course website, hardware data sheets and manuals, scientific publications.

Assessment methods and criteria:

Project report and a demonstrated implementation.
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:

Teemu Tokola

Working life cooperation:

The topics of the course are relevant research topics with applications in the industry, and visiting lecturers are occasionally arranged to shed light on how the course topics are applied in the industry.

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.

812671S: Usability Testing, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Mikko Rajanen

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

English and Finnish

Timing:

The course is held in the spring semester, during periods 3 and 4.

Learning outcomes:

After completing the course, the student can:

- Design and follow through a usability testing process;
- Design usability test scenarios and tasks;
- Select test subjects;
- Plan and follow through usability tests as laboratory tests or field tests;
- Analyse and report the findings from usability tests.

Contents:

Basic terms and types of usability testing, usability tests process, usability test tasks and scenarios, test subjects, following through a usability test, analysing usability test material, reporting the findings from usability tests.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 24h, assignment tutoring 13h, assignment 90h, seminar 7h.

Target group:

MSc students

Prerequisites and co-requisites:

Student is familiar with most common user interface design terms, design and evaluation methods as in “Introduction to Human-Computer Interactions” course.

Recommended optional programme components:

Recommended or required reading:

Dumas, J. S. & Redish, J. C. (1993): A Practical Guide to Usability Testing. Ablex Publishing Corporation.
Rubin, J. (1994): Handbook of
Usability Testing: How to Plan, Design, and Conduct Effective Tests. Chichester: John Wiley & Sons, Inc.

Assessment methods and criteria:

Assessment of the course is based on the learning outcomes of the course based on the written usability test plan, supervised usability tests, written usability test report and oral seminar presentation

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Mikko Rajanen

Working life cooperation:

No

Other information:

521013A: Advanced Practical Training, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Riku Hietaniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

521027S	Advanced practical training	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
3
Language of instruction:
Finnish/English
Timing:
Whole academic year. Periods 1-4.
Learning outcomes:
After the advanced practical training the student can describe one possible future job, or another kind of position in an already familiar working environment. The student can identify problems in the working environment and solve them. The student can apply theoretical knowledge acquired in the studies to practical tasks. The student can identify roles of a diploma-engineer in the work place.
Contents:
Training in the research laboratories, development laboratories and process laboratories, among others, of the industry and institutions in the field of study. The technical goal of practical training is to give a general insight of the field in which the trainee will work after having taken the degree and to support and to promote theoretical studying. Likewise, the training has to acquaint the trainee with the social points of the industrial production and with industrial safety and has to give a sufficient picture of the technical details of the performing of different work. Furthermore, the training gives a general idea of the technical and economic organizing, administration and management of a company and its production.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
Students find their training jobs themselves.
Target group:
Computer Science and Engineering MSc students.
Prerequisites and co-requisites:
None.
Recommended optional programme components:
-
Recommended or required reading:
None.
Assessment methods and criteria:
For the compulsory MSc stage practical training lasting at least two months a training report is required for which an acceptable grade must be obtained. A more exact compilation instruction of the training report is on the WWW pages of the degree programs.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.
Person responsible:
Riku Hietaniemi
Working life cooperation:
Yes.

521993S: Master's Thesis in Computer Engineering, 30 op

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
30
Language of instruction:
Finnish/English
Timing:
Second year of MSc studies
Learning outcomes:
The student is able to set goals for a given task. He can structure the topic coherently, with emphasis on the key issues. Depending on the nature of the work, the student is able to present the existing results or technological implementations so that the methods used in the work are justified in relation to the state of the art in the field of engineering or science in question. He is able to apply the knowledge and state of the art methods of the subject area in his work. He can present clearly his plan and solution implemented, justify the choices made, and assess the functionality of the solution with relevant testing and evaluation methods. In addition, he is able to compare the results against goals and to consider their general significance to modern engineering or science, and assess the broader significance of the results to the company, organization or project. The student is able to produce smooth, clear and finalized text based on technical and scientific writing practices of the field.
Contents:
The thesis work is carried out independently. The student defines the content of the thesis under the guidance of the supervisor. The degree program committee approves the thesis topic and content.
The thesis is recorded in accordance with the orientation using the following codes:

- 521981S Master's Thesis in Information Processing Engineering, 30 ECTS cr
- 522985S Master's Thesis in Applied Computing, 30 ECTS cr
- 521984S Master's Thesis in Embedded Systems, 30 ECTS cr

Mode of delivery:
Face-to-face meetings with the supervisor and independent studying.
Learning activities and teaching methods:
Independent work under the guidance of the supervisor.
Target group:
Second year MSc students.
Prerequisites and co-requisites:
Compulsory advanced studies preceding the thesis (90 ECTS cr).
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
The thesis is assessed by two reviewers (supervisor and second reviewer) and approved by the degree program committee. Assessment Criteria at the University of Oulu can be found here.
Grading:
1-5 (1=sufficient, 2=satisfactory, 3=good, 4=very good, 5=excellent)
Person responsible:
Supervising professor or researcher
Working life cooperation:
Yes.
Other information:
Detailed instructions: http://www.oulu.fi/cse/studying/masters-thesis

A452120: Basic and Intermediate Studies, Information Engineering, 120 - 150 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Basic and Intermediate Studies

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Second official language, select 2

901048Y: Second Official Language (Swedish), Written Skills, 1 op

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

901060Y Second Official Language (Swedish), Written Skills 1.0 op
ay901048Y Second Official Language (Swedish), Written Skills (OPEN UNI) 1.0 op

901049Y: Second Official Language (Swedish), Oral Skills, 1 op

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

901061Y Second Official Language (Swedish), Oral Skills 1.0 op
ay901049Y Second Official Language (Swedish), Oral Skills (OPEN UNI) 1.0 op

900081Y: Second Official Language (Finnish), Written Skills, 1 - 2 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Languages and Communication
Opintokohteen kielet: Finnish

900082Y: Second Official Language (Finnish), Oral Skills, 1 - 3 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Languages and Communication
Opintokohteen kielet: Finnish

Compulsory studies

521002P: Orientation to Computer Science and Engineering, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Riku Hietaniemi
Opintokohteen kielet: Finnish

Leikkaavuudet:

521005P Orientation Course for New CSE Students 1.0 op

ECTS Credits:

5

Language of instruction:

Main language is Finnish, but can be completed with English.

Timing:

Course will be arranged during Autumn / Spring in periods I-II. Course is obligatory for first year computer engineering students.

Learning outcomes:

1. Student understands the characteristics of studying in computer science and engineering program and knows about the devices and software related to the studies.

2. Student has created his personal study plan, participates in community activities, and is aware of the challenges related to studying.

3. Student has gained hands-on experience with computer gadgets, Linux systems, agile software development tools and scientific computing environment.

4. Student understands how microcontroller devices operate and how signal data can be manipulated using Matlab software environment.

5. Student has gained knowledge on scientific principles (academic responsibility, studying and ways of work) and understands the responsibility over his personal studies.

6. Student knows his degree program, key university personnel, tutor and small group.

7. Student has become acquainted with the degree structure, goals and content, and knows how to create a personal study plan (HOPS) to achieve the degree.

8. Student has practical knowledge about initializing his studies and utilizing Lukkari service to plan and manage his studies and time use.

Contents:

Comprises of the following sections: Study planning, studying in communities, introduction to Matlab computing environment, introduction to Linux systems, introduction to agile software development tools, and introduction to programmable gadgets.

Mode of delivery:

Course is based on blended teaching (web-based teaching + face-to-face teaching).

Learning activities and teaching methods:

Lectures: 2+4 h (student counseling) 4+4 h (seminars) 6 h (introduction to Matlab 4 h (introduction to Linux systems) = 24 h Group work: 20 h (small-group meetings) 7 h (introduction to programmable gadgets -> one day) 3*4h (introduction to agile tools) PSP Advising 2 h = 41 h Self-studying: 70 h (study planning and follow-up, self study) Linux-systems and programmable gadgets are organized as one-day courses. Introductions to Matlab and agile software development tools are given as three lectures. The courses give guided introductions to scientific computation environments, agile tools, Linux systems and programmable gadgets in order to get student acquainted with the tools and technologies they need in their further studies. The sections require attendance in the organized seminars, guided teaching sessions and small-group meetings as well as creating personal study plan, time tracking and reporting. To pass Orientation to computer science course and get credits, all sections of the course must be passed.

Target group:

Computer science and engineering students.

Prerequisites and co-requisites:

-

Recommended optional programme components:

The course is designed to carry out in the first year while planning and following obligatory studies in computer science and engineering.

Recommended or required reading:

Study material is provided during guided teaching and seminars.

Assessment methods and criteria:

The course utilizes continuous assessment. To pass sub-sections, student is required to attend in the organized seminars and guided teaching sessions, creating personal study plan, time tracking and reporting.

Grading:

The course will be graded as “pass / fail”.

Person responsible:

Riku Hietaniemi

Working life cooperation:

-

Other information:

-

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Lusikka

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 can be completed in English by intermediate exams or by a final exam.

Timing:

Autumn semester, period 1

Learning outcomes:

Upon completion of the course, the student identifies concepts of vector algebra, can use vector algebra for solving problems of analytic geometry, can explain basic characteristics of elementary functions, is able to analyse the limit and the continuity of real valued functions of one variable, can solve problems associated with differential and integral calculus of real valued functions of one variable.

Contents:

Vector algebra and analytic geometry. Limit, continuity, differential and integral calculus and applications of real valued functions of one variable. Complex numbers.

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:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Grossman, S.I.: Calculus of One Variable; Grossman, S.I.: Multivariable Calculus, Linear Algebra, and Differential Equations (partly); Adams, R.A.: A Complete Course Calculus (partly)

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 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: 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:

1. Vectors and matrices 2. Systems of linear equations. 3. Matrix factorizations. 4. Vector spaces. 5. The rank, nullity, row space and the column space of a matrix. 6. The determinant of a matrix. 7. Eigenvalues and eigenvectors of a matrix. 8. The diagonalization with applications.

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:

Recommented literature: Grossman, S.I: Elementary Linear Algebra; David C. Lay: Linear Algebra and Its Applications.

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:

-

521141P: Elementary Programming, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Mika Oja, Mika Rautiainen

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 can be completed in English by self-studying from a book, completing assignments and exercises on the course learning environment, and delivering a final project.

Timing:

Fall, period 1. There is an option to extend the course to the 2nd period in cases where completing in one period doesn't fit the student's schedule.

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:

1 st 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:

-

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Lusikka

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, 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:

Face-to-face 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 Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E: Advanced Engineering Mathematics; Grossman S.I.: Multivariable Calculus, Linear Algebra, and Differential Equations; Adams, R.A.: A Complete Course Calculus.

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 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

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:

Face-to-face 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 prerequisities 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:

Milton, J.S., Arnold, J.C. (1992): Introduction to Probability and Statistics.

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:

-

Other information:

-

902011P: Technical English 3, 6 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

031077P: Complex analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

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-toface 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:

-

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:

1. Elementary logic 2. Mathematical induction 3. Elementary number theory 4. Set theory 5. Elementary graph theory 6. Elementary theory of formal languages 7. Theory of automata and Turing machines

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:

Recommented literature: Rosen K.H.: Discrete Mathematics and Its Applications. Gersting J.L.: Mathematical Structures for Computer Science.

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:

-

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: 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 credits

Language of instruction:

Finnish

Timing:

Architecture 3. spring semester, period I; biochemistry 3. autumn semester; biology 3. autumn semester, period I; chemistry 3. autumn semester, period II; computer science and engineering 2. spring semester, period IV; electrical engineering 3. spring semester, period III; geosciences 2. spring semester, period IV; geography 1. and 3. spring semester, *period III;* industrial engineering and management 3. year*;* information processing sciences 1. year; mathematics and physics 1. spring semester; mechanical engineering 3. year; mining engineering and mineral processing 3. year; process and environmental engineering 1. year, period I. 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 RefWorks 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, Oulu mining school, Oulu School of architecture and Faculty of science. Optional for students of biochemistry. Compulsory also for the Master's degree students in Industrial Engineering and Management who have not earlier studies in information skills.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Web learning material Tieteellisen tiedonhankinnan opas http://libguides.oulu.fi/tieteellinentiedonhankinta

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

Working life cooperation:

-

Other information:

-

031076P: Differential Equations, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: 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:

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:

The recommended prerequisite is the completion of the course Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Recommented 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.
Lue lisää opintosuoritusten arvostelusta yliopiston verkkosivulta.

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:

-

761113P: Electricity and magnetism, 5 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761119P	Electromagnetism 1	5.0 op
761119P-01	Electromagnetism 1, lectures and exam	0.0 op
761119P-02	Electromagnetism 1, lab. exercises	0.0 op
766319A	Electromagnetism	7.0 op
761103P	Electricity and Magnetism	4.0 op

ECTS Credits:

5 ECTS cr

Language of instruction:

Finnish

Timing:

Spring

Learning outcomes:

The student is able to describe the basic concepts of electricity and magnetism and to apply those when solving the problems related to electromagnetism.

Contents:

Electromagnetic interaction is one of the four fundamental interactions in physics and many phenomena like light, radio waves, electric current, magnetism and formation of solid matter are based on electromagnetism. The current technological development is largely based on applications of electromagnetism in energy production and transfer, telecommunications and information technology.
Contents in brief: Coulomb’s law. Electric field and potential. Gauss’s law. Capacitors and dielectrics. Electric current, resistors, electromotive force and DC circuits. Magnetic field, motion of a charged particle in electric and magnetic fields, and applications. Ampère’s law and Biot-Savart law. Electromagnetic induction and Faraday’s law. Inductance and inductors. R-L-C circuits, alternating current and AC circuits.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, 6 exercises (12 h), 2 laboratory exercises (8 h), 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 are needed.

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2012, chapters 21-31. Also older editions can be used.
Lecture material: Finnish lecture material will be available on the web page of the course.
Course material availability can be checked here.

Assessment methods and criteria:

Four written intermediate examinations or final examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Timo Asikainen

Working life cooperation:

No work placement period

Other information:

https://wiki.oulu.fi/display/761113P/

521159P: Principles of Digital Fabrication, 5 op

Voimassaolo: 01.01.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: 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:

Face-to-face teaching (Lectures)/ Individual work towards project

Learning activities and teaching methods:

Lectures 12h / Individual work 123h. There are sessions each week in FabLab where guidance is available.

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:

The course is evaluated pass/fail only

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.

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: Olli Silven

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:

The language of instruction is Finnish with part of the material in English. The course is implemented as exercises done by groups of participants.

Timing:

The course is held during the period IV in the Spring semester, and it is recommended for the 1st or 2nd year.

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 is able to recognize search, regression, classification, and clustering problems, and to explain the use of supervised and nonsupervised learning, performance measurements and metrics.

Contents:

1. Introduction: the role of artificial intelligence
2. Search methods: artificial intelligence in games

3. Regression methods: learning of causalities
4. Classication methods: recognition of categories
5. Clustering methods: identification of category structure
6. Supervised learning
7. Unsupervised learning

Mode of delivery:

The course is implemented face-to-face teaching

Learning activities and teaching methods:

Lectures 42h / group work 70 h / elf-study 23 h. The exercises are completed as group work in multi-disciplinary teams.

Target group:

The course is suitable for all students, but due to the nature of the exercises some elementary programming skills are needed in each student group.

Prerequisites and co-requisites:

No prerequisites

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 modeled loosely based on the University of Washington's Coursera module "Machine learning foundations: a case study approach"

Assessment methods and criteria:

The course utilizes continuous assesment. During the course there are 6 intermediate exams of which 5 best ones will be used in final evaluation. The course includes 5 group exercises of which at least 4 need to be passed.
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:

Olli Silvén

Working life cooperation:

The course includes guest presentations on the artificial intelligence applications

Other information:

-

Compulsory Intermediate Studies

521109A: Electrical Measurement Principles, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Saarela

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:

Juha Saarela

Working life cooperation:

None.

Other information:

-

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: Antti Mäntyniemi

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 execise 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
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS

Language of instruction:

All materials are in English, lectures are given in Finnish.

Timing:

Spring, period 4.

Learning outcomes:

1. is able to explain the design principles, architecture, functionality and challenges of the public internet

2. understands data link layer's role and most important access network technologies

3. is able to explain the structure and most important protocols of the TCP/IP protocol stack

4. knows most important internet applications and their protocols

5. understands the principles of internet security and multimedia applications

6. is able to solve simple internet related problems

7. is able to program a small internet application

Contents:

Internet’s design principles and architecture, 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:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 32 h / problem solving exercises 14 h / laboratory exercises 12 h / course work 25 h / self-study 52 h. Problem solving exercises, laboratory exercises and course work are completed as group work.

Target group:

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:

-

Recommended or required reading:

Announced at the beginning of the course.

Assessment methods and criteria:

The course uses continuous assessment so that there are 3 intermediate exams. Alternatively, the course can also be passed with a final exam. The course includes a mandatory course work.

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

Grading:

The course uses numerical grading scale 1-5.

Person responsible:

Dr. Timo Koskela.

Working life cooperation:

-

Other information:

-

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:

After completing 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 and face-to-face teaching.

Learning activities and teaching methods:

Lectures (36h), course exercises (10-20h), 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 electrical 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:
Bryant & O'Hallaron, Computer Systems: A Programmer's Perspective, 3rd Edition, Chapters 1-9.
Patterson & Hennessy, Computer Organization and Design: The Hardware/Software Interface, 5th Edition, Chapters 1-2, 4-5.

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.
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:

Teemu Leppänen

Working life cooperation:

Visiting lectures with experts from local industry are possible.

Other information:

-

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:

After finishing the course, the student knows the basic concepts of software and real-time systems, the different areas of project management, the phases of software development and the goals and tasks of them,
is able to use structural methods for defining systems and knows the principles of object-oriented design and analysis.
After the course, the student has basic knowledge of utilizing software tools for structural analysis and design.

Contents:

Problematics 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.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

The course consists of lectures and a laboratory design exercise. The course is completed by a final exam and a successfully completed exercise. Lectures 30 h, laboratory design (in period 3) 12 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:

521141P Elementary Programming, 521286A Computer Systems or 521142A Embedded Systems 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:

R.S. Pressman: Software Engineering - A Practitioner's Approach. Sixth Edition. McGraw-Hill 2005, chapters 1-11, 13-14 and 21-27. Older editions (4th and 5th) can also be used as a reference. In this case the lectures are based on chapters 1-20.

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:

-

Other information:

-

521145A: Human-Computer Interaction, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Simo Hosio, Denzil Teixeira Ferreira

Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Autumn, period 2

Learning outcomes:

1. Knowledge of the Human Computer Interaction (HCI) fundamentals

2. Knowledge of evaluation techniques

3. Knowledge of prototyping techniques

4. Knowledge of how HCI can be incorporated in the software development process

Contents:

Human and computer fundamentals, design and prototyping, evaluation techniques, data collection and analysis.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures (20 h), exercises (20 h), and practical work (95 h). The course is passed with an approved practical work. The implementation is fully 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 programming and design skills are desired.

Recommended optional programme components:

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

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete 4 individual exercises throughout the semester: 1: Using questionnaires; 2: Grouping & clustering; 3: Fitts' law; 4: Advanced evaluation & visualisations. Passing criteria: all 4 exercises must be completed, each receiving more than 50% of the available points.
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:

Denzil Ferreira

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: Ari Vesanen

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. One English exercise group will be arranged.

Timing:

The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd study year.

Learning outcomes:

After completing the course the student is able to - describe the concept of algorithm - explain correctness and time complexity of an algorithm - describe the complexity classes of the sorting algorithms presented - prove algorithm correctness - estimate the running time of an algorithm related to the size of the input - describe the data structures presented - argue how to choose a data structure or an algorithm to an application - apply basic graph algorithms - construct a program that applies appropriate data structures to solve a given problem

Contents:

1. Algorithms and their analysis 2. Search and sort algorithms and their time complexity 3. Basic data structures 4. Hash tables 5. Binary search trees 6. Graphs and their algorithms 7. Algorithm design paradigms

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 48h, exercises 21h, assignment (27), independent work 39h.

Target group:

BSc students.

Prerequisites and co-requisites:

811120P Discrete structures or similar knowledge. Basic skills in programming

Recommended optional programme components:

Recommended or required reading:

Cormen, Leiserson, Rivest, Stein: Introduction to algorithms, 2nd edition, MIT Press 2001 (or later). From this edition chapters 1–4, 6–13, 15–16, 22–24, Appendix A and B are covered.

Assessment methods and criteria:

Exam and assignment.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Ari Vesanen

Working life cooperation:

No

031080A: Signal Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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 or a retake 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 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 explain the mathematical grounds of the most central optimal systems used in signal estimation
-can solve related problems

Contents:

Signals, classification, frequency. Fourier analysis, analog and digital signal, fast Fourier transform. Random variable. Random signal. Stationarity, autocorrelation. Power spectral density. Poisson process, RTS-signal. Signal estimation, orthogonality principle, Yule-Walker equations, Wiener filter.

Mode of delivery:

Blended teaching.

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:

Lecture notes. Additional reading: Proakis, J.G., Manolakis, D.K.: Introduction to Digital Signal Pro-cessing. Shanmugan, K.S., Breipohl, A.M.: Random Signals, Detection, Estimation and Data Analysis.

Assessment methods and criteria:

The course is completed with a final exam or a retake exam. In addition to the final exam, STACK-assignments given during the course are part of the 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 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vesa Kotila

Working life cooperation:

-

Other information:

-

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 30 h, laboratory exercise 6 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:

Lecture notes (in Finnish) and exercise material. Silberschatz A., Galvin P., and Gagne G.: Operating System Concepts, 6th edition (or newer), John Wiley & Sons, Inc., 2003. Chapters 1-12.

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

Working life cooperation:

-

Other information:

-

521495A: Artificial Intelligence, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Abdenour Hadid

Opintokohteen kielet: English

Leikkaavuudet:

ay521495A	Artificial Intellig (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Period 3.

Learning outcomes:

1. is able to identify the types of problems that can be solved using methods of artificial intelligence.
2. knows the basic concepts of intelligent agents, the common search methods used in artificial intelligence, logic based reasoning and applying planning techniques to problems of artificial intelligence.
3. can also apply simple methods to reasoning under uncertainty and machine learning from observation.
4. In addition the student will be able to implement the most common search methods.

Contents:

1) Introduction, 2) Rational (Intelligent) Agents and Uninformed Search, 3) Informed Search, 4) Programming Project 1 (Pacman 1), 5) Adversarial Search (Games), 6) Programming Project 2 (Pacman 2), 7) Uncertainty and Utilities, 8) Markov Decision Processes, 9) Reinforcement Learning, 10) Bayesian Networks, 11) Machine Learning (learning from Observation), 12) Advanced Applications, 13) Conclusions

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

24 hours of lectures and a programming exercise (approximately 25 hours) during period 3, the rest as independent work.

Target group:

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

Prerequisites and co-requisites:

Programming 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:

The course material is based on the Artificial Intelligence course of Berkely University and the book "Artificial Intelligence, A Modern Approach" by Russell & Norvig.
1) http://ai.berkely.edu
2) Russell S., Norvig P.: Artificial Intelligence, A Modern Approach, Second Edition, Prentice Hall, 2003.

Assessment methods and criteria:

The course is passed with a final exam and a passed programming exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 / fail.

Person responsible:

Abdenour Hadid
Zinelabidine Boulkenafet

Working life cooperation:

-

Other information:

-

521467A: Digital Image Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay521467A	Digital Image Processing (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

Lectures in Finnish and exercises in English. Course can be passed in Finnish and English.

Timing:

Autumn, period 1.

Learning outcomes:

Upon completion of the course the student:
- understands the basic theory of digital image processing and knows its main applications,
- is able to apply spatial and frequency domain and wavelet based methods in image enhancement, restoration, compression and segmentation.

-

Contents:

1. Fundamentals of digital images, 2. Image enhancement in spatial and frequency domains, 3.Image restoration, 4. Color image processing, 5. Wavelets, 6. Image compression, 7. Morphological image processing and 8. Image segmentation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 24 h, exercises 14 h and homework assignments 30 h. The rest is independent work.

Target group:

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

Prerequisites and co-requisites:

None.

Recommended optional programme components:

In order to obtain deep understanding of the content, it is a benefit if the student has completed the mathematics courses in the computer science and engineering BSc program or otherwise has equivalent knowledge.

Recommended or required reading:

Gonzalez, R.C., Woods, R.E.: Digital Image Processing, Third Edition, Prentice-Hall, 2008, Chapters 1-10. Lecture notes and exercise

Assessment methods and criteria:

The course is completed by passing the exam and homework assignments.
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:

Janne Heikkilä

Working life cooperation:

None.

Other information:

-

Complusory Bachelor's Thesis

523991A: Bachelor's Thesis / Information Engineering, 8 op

Voimassaolo: 01.08.2007 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish. Bachelor's thesis can be written also in English.

Timing:

All periods

Learning outcomes:

The student is able to set goals for a given task. He can structure the topic coherently, with emphasis on the key issues. The student is able to use sources of information critically. He can present clearly his plan and solution implemented, justify the choices made, and assess the functionality of the solution with relevant testing and evaluation methods. In addition, he is able to compare the results against goals, and produce smooth, clear and finalized text based on technical and scientific writing practices of the field.

Contents:

The student selects the topic together with the supervisor.

Mode of delivery:

Independent work.

Learning activities and teaching methods:

Course is completed at the end of bachelor’s studies, typically, in the spring semester of the third study year. The work may be a theoretical or practically oriented study from a topic provided by a company or a research group.

Target group:

Computer Science and Engineering students.

Prerequisites and co-requisites:

Compulsory basic and intermediate studies and the module preparing for the option.

Recommended optional programme components:

-

Recommended or required reading:

-

Assessment methods and criteria:

Bachelor's thesis and the maturity test. Assessment Criteria at the University of Oulu can be found here. Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass / fail

Person responsible:

Professors and researchers in the Department of Computer Science and Engineering.

Working life cooperation:

Yes

900060A: Technical Communication, 2 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900060A	Technical Communication (OPEN UNI)	2.0 op
470218P	Written and Oral Communication	3.0 op

Proficiency level:

-

Status:

This course unit is compulsory for students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.

Required proficiency level:

-

ECTS Credits:

2 credits

Language of instruction:

Finnish

Timing:

1st year: Process and Environmental Engineering
2nd year: Communications Technologies
3rd year: Geoscience; Mechanical Engineering; Electrical Engineering, Computer Science and Engineering Technologies

Mode of delivery:

Multimodal teaching

Learning activities and teaching methods:

Contact hours ca. 20 h and independent group work or self-study ca. 34 h.

Target group:

Bachelors students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Kauppinen, Anneli & Nummi, Jyrki & Savola, Tea: Tekniikan viestintä: kirjoittamisen ja puhumisen käsikirja (EDITA); Nykänen, Olli: Toimivaa tekstiä: Opas tekniikasta kirjoittaville (TEK) and material in Optima study 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:

Pass / fail

Person responsible:

Kaija Oikarainen
Toropainen, Outi

Working life cooperation:

-

Other information:

All students are required to attend the first meeting of the course unit so the work groups can be formed and work started in a timely and efficient manner. When signing up for the course unit, you should keep in mind that completing it requires a responsible attitude and a strong commitment to the work because the teamwork-based exercises rely heavily on the participation and activity of the students.
If the student is involved in the University's student associations or functions in a position of trust in university government, student union administration or Oulun Teekkariyhdistys ry (or in its subordinate guilds), he/she may be relieved of some of the group communication exercises. These compensatory actions must always be agreed upon separately with the course unit's teacher. The student must present an official statement from a person in charge of the governing body or association, which details the student's tasks and involvement with that body or association. Participation that took place over five years ago does not entitle the student to any compensation.

A452121: Module Preparing for the Option, Information Technology, 10 - 30 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory studies

031022P: Numerical Analysis, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Marko Huhtanen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish. English speaking students should contact the instructor.
The course can be completed in English by intermediate exams or by a final exam.

Timing:

Spring semester, period 3

Learning outcomes:

Knows numerical algorithms for solving basic problems in computing. Knows basics about numerical linear algebra and some of its applications. Knows how nonlinear systems are solved and how they appear in optimization. Knows how differential equations are solved numerically.

Contents:

Numerical linear algebra, numerical methods for systems of equations, unconstrained optimization, basics of the approximation theory, numerical quadratures, numerical methods for ordinary differential equations.

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:

-

Prerequisites and co-requisites:

Completion of courses Calculus I and II, a course on Differential Equations and a Course on Linear Algebra.

Recommended optional programme components:

-

Recommended or required reading:

Material posted on the web-page of the course.

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 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Marko Huhtanen

Working life cooperation:

-

Other information:

-

521337A: Digital Filters, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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:

1. Sampling theorem, aliasing and imaging, 2. Discrete Fourier transform, 3. Z-transform and frequency response, 4. Correlation and convolution, 5. Digital filter design, 6. FIR filter design and realizations, 7. IIR filter design and realizations, 8. Finite word length effects and analysis, 9. Multi-rate signal processing.

Mode of delivery:

Face-to-face teaching (Lectures), independent work, group work

Learning activities and teaching methods:

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:

Lecture notes and exercise materials. Material is in Finnish and in English. Course book: Ifeachor, E., Jervis, B.: Digital Signal Processing, A Practical Approach, Second Edition, Prentice Hall, 2002.

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:

-

521330A: Telecommunication Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Kari Heikki Antero Kärkkäinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

521357A	Telecommunication Engineering 1	3.0 op
521361A	Basics of Digital Communications	3.0 op

ECTS Credits:

5

Language of instruction:

Finnish. The course can be completed in other languages e.g. in English as a book examination.

Timing:

The course is held in period 4.

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 coherenr 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:

Essential and optional blocks of coherent and non-coherent analog and digital transmission systems and their operation principles. Linear (amplitudemodulation) and non-linear (anglemodulation) modulation principles, and differences in their performance and operation. Carrier and pulse modulation principles and their differences. The most important analog (DSB, AM, SSB, VSB, PM, FM, PAM,PWM, PPM) and digital (ASK/MASK, PSK/MPSK, FSK/MFSK, DPSK, QPSK/OQPSK, MSK/GMSK, QAM, MCM/OFDM, TCM, DM, PCM) carrier and pulse modulation methods and their performance analysis (SNR, BEP) and comparison based on the AWGN channel model. Influence of single-tone carrier radiofrequency interference (RFI) in the case of analog modulations. The threshold effect in the case of non-linear modulations and non-linear detectors. Mixing-principle and superheterodyne receiver. Phase-lock loop techniques, and FDM, TDM and QM-multiplexing methods. Matcher filter and correlation receiver principles. Characteristics and modelling of radio channels. Influence of band-limiting and multi-path propagation (inter-symbol interference ISI & fading) on system performance. Diversity, channel equalizing and MCM/OFDM methods for reducing channel interference. Spread-spectrum technique, and benefits & limitations & applications of that principle. Cellular system idea. Basics of information theory, source coding and error-control coding methods.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Face-to-face teaching 52 h. No separate times for class-ecercises. Exercises are integrated as part of face-to-face teaching event. Self-study 73 h. Total 125 h.

Target group:

Second year B.Sc.(Tech.) students in electrical engineering and computer engineering degree programmes.

Prerequisites and co-requisites:

031080A Signal analysis course.

Recommended optional programme components:

No connections to other courses.

Recommended or required reading:

Lecture slides in Finnsih are stored into the TTK-OPTIMA environment. The course and lecture slides are based on the book: R.E. Ziemer & W.H. Tranter: Principles of Communications: Systems, Modulation and Noise, 7th edition, 2015, John Wiley & Sons, Partially chapters: Ch 1 (ss. 1-16), Ch 3 (112-151), Ch 4 (ss. 156-184, 194-209), Ch 5 (ss. 215-216, 225-239), Ch 8 (ss. 349-361, 370-380, 384-390), Ch 9 (ss. 396-468), Ch 10 (ss. 477-516, 528-532, 540-546, 553-557), Ch 12 (ss. 615-647, 657-664, 668-670, 679-683).

Assessment methods and criteria:

Course can be passed either with several mini-exams during course, or with final exam.

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).

A452149: Module Preparing for the Option, Applied computing, 10 - 30 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory studies

521151A: Applied Computing Project I, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

521041A Applied Computing Project I 8.0 op

ECTS Credits:

10 ECTS cr

Language of instruction:

In English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

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:

Project work that is typically executed in groups of 3-5 students. Note: the project work cannot be done alone.

Mode of delivery:

3-4 lectures to introduce and conclude the course and project works, collaborative project work for a "client" (teaching assistants and/or industry representatives)

Learning activities and teaching methods:

Practical work in project teams. The course is passed with an approved project work. The implementation is fully in English.

Target group:

3rd year Computer Science and Engineering B.Sc. students and other Students of the University of Oulu.

Prerequisites and co-requisites:

While no specific courses are not required, elementary programming and design skills are desired.

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:

For additional reading (not mandatory): Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).

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

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Matti Pouke, Denzil Ferreira

Working life cooperation:

No

Other information:

-

521157A: Introduction to Social Network Analysis, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: 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 2. It is recommended to complete the course at the end of period 2

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 (10h), 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:

R. Zafarani, M. A. Abbasi, and H. Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014

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 humanties, 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.

A452123: Module Preparing for the Option, Embedded Systems, 10 - 30 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory studies

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:

Equation of basic circuit elements, circuit laws and systematic building of network equations. Calculation of time and frequency responses. Use of complex phasor arithmetics. Basics of the use of circuit simulators.

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 cources.

Recommended or required reading:

Nilsson, Riedel: Electric Circuits (6th or 7th ed., Prentice-Hall 1996), Chapters 1-11.

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:

-

521431A: Principles of Electronics Design, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Kostamovaara

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, operational amplifier, 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.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

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:

Circuit Theory I

Recommended optional programme components:

Recommended course Principles of Semiconductor Devices.

Recommended or required reading:

Lecture notes, Razavi: Fundamentals of Microelectronics (John Wiley & Sons 2008), chapters 1-8 and 15 partially or Sedra & Smith : Microelectronic Circuits (6th ed.), chapters 1-5 and 14.

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:

Juha Häkkinen

Working life cooperation:

-

521337A: Digital Filters, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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:

1. Sampling theorem, aliasing and imaging, 2. Discrete Fourier transform, 3. Z-transform and frequency response, 4. Correlation and convolution, 5. Digital filter design, 6. FIR filter design and realizations, 7. IIR filter design and realizations, 8. Finite word length effects and analysis, 9. Multi-rate signal processing.

Mode of delivery:

Face-to-face teaching (Lectures), independent work, group work

Learning activities and teaching methods:

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:

Lecture notes and exercise materials. Material is in Finnish and in English. Course book: Ifeachor, E., Jervis, B.: Digital Signal Processing, A Practical Approach, Second Edition, Prentice Hall, 2002.

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:

-

H452229: Other Supplementary Module (Computer Science and Engineering), 15 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Supplementary Module / Bachelor's Degree

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

Supplementary module primarily consists of a preparatory module of another orientation (Information Processing Engineering, Applied Computing or Embedded Systems). Another alternative is to select the supplementary module from the fields of Electrical Engineering, Information Processing Science, Industrial Engineering and Management, Working life & Entrepreneurship, or Economics and Management. In all cases the extent of the supplementary module is 15 ECTS cr.

A452127: Module Preparing for the Option, Artificial Intelligence, 20 op

Voimassaolo: 01.08.2018 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

A452149: Module Preparing for the Option, Applied computing, 10 - 30 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory studies

521151A: Applied Computing Project I, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English
Leikkaavuudet:

521041A	Applied Computing Project I	8.0 op

ECTS Credits:

10 ECTS cr

Language of instruction:

In English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

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:

Project work that is typically executed in groups of 3-5 students. Note: the project work cannot be done alone.

Mode of delivery:

3-4 lectures to introduce and conclude the course and project works, collaborative project work for a "client" (teaching assistants and/or industry representatives)

Learning activities and teaching methods:

Practical work in project teams. The course is passed with an approved project work. The implementation is fully in English.

Target group:

3rd year Computer Science and Engineering B.Sc. students and other Students of the University of Oulu.

Prerequisites and co-requisites:

While no specific courses are not required, elementary programming and design skills are desired.

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:

For additional reading (not mandatory): Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).

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

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Matti Pouke, Denzil Ferreira

Working life cooperation:

No

Other information:

-

521157A: Introduction to Social Network Analysis, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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 2. It is recommended to complete the course at the end of period 2

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 (10h), 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:

R. Zafarani, M. A. Abbasi, and H. Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014

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 humanties, 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.

A452126: Module Preparing for the Option, Computer Engineering, 20 op

Voimassaolo: 01.08.2018 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Supplementary Module: Electrical Engineering (15 ECTS cr)

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:

Equation of basic circuit elements, circuit laws and systematic building of network equations. Calculation of time and frequency responses. Use of complex phasor arithmetics. Basics of the use of circuit simulators.

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 cources.

Recommended or required reading:

Nilsson, Riedel: Electric Circuits (6th or 7th ed., Prentice-Hall 1996), Chapters 1-11.

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:

-

521431A: Principles of Electronics Design, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Kostamovaara
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, operational amplifier, 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.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

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:

Circuit Theory I

Recommended optional programme components:

Recommended course Principles of Semiconductor Devices.

Recommended or required reading:

Lecture notes, Razavi: Fundamentals of Microelectronics (John Wiley & Sons 2008), chapters 1-8 and 15 partially or Sedra & Smith : Microelectronic Circuits (6th ed.), chapters 1-5 and 14.

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:

Juha Häkkinen

Working life cooperation:

-

521077P: Introduction to Electronics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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:

Structures and interfaces of electronic devices. Electromagnetic properties of materials (conductivity, dielectricity, magnetism and semiconductivity).Electronics components (resistors, capacitors, inductive components and semiconductors). Interconnection technologies and circuit board technologies. The future of electronic materials and application areas.

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:

-

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

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: 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

Language of instruction:

Finnish

Timing:

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

Learning outcomes:

1. has become acquainted with wireless communication technologies with the aid of small laboratory measurement works, which do not require prior courses on telecommunication engineering.

2. has observed and learned the operation principles, properties and limitations of existing wireless communication systems.

3. has learned how to use measurement techniques and methods with the aid of modern measurement instruments in laboratory environment.

4. knows how to approach different kinds of wireless communication problems by utilizing hands-on engineering work practices.

Contents:

Students are introduced to the wireless communication systems and corresponding phenomena with the aid of guided laboratory exercises. The course utilizes within reasonable limits various existing wireless communication systems, in order to create simple connections between various equipments and modules in a laboratory environment.

Mode of delivery:

Face-to-face teaching and guided laboratory exercises. Self-studying at home between work themes. Writing of final report.

Learning activities and teaching methods:

Course consist of few small separate measurement problems dealing with wireless transmission. Before each work theme relevant theory and work instructions needed to complete the work are given. Students will participate in briefing lectures (appr. 2 h/theme) which introduce the theory needed to conduct each laboratory work problem. In addition, instructions to perform the work are given. After each lecture students will move to a measurement laboratory, and will study a given problem with the aid of measuring instruments in a laboratory environment under teacher's quidance. Work subjects are done within a group of several students, and measuremnt results are summarized in a written final report. Course contains face-to-face teaching and quided laboratory work among themes, and self-study between work themes. For the end, students perform discussion and reporting of results. Final exam is not arranged.

Target group:

Second year bachelor level electrical engineering students.

Prerequisites and co-requisites:

No prerequisities.

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 available. Materials will be placed into TTK-OPTIMA environment during the course.

Assessment methods and criteria:

All students of a group will participate in introductory face-to-face teaching and will prepare a final report according teacher's instructions. Participation in all introductory lectures and laboratory exercises is mandatory for all members of a group. In addition, final report has to be in form required by a course teacher, and the content has to be satisying from acceptance standpoint.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Work grading accepted/rejected. No numerical grading.

Person responsible:

Kari Kärkkäinen

Working life cooperation:

No

521104P: Introduction to Material Physics, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Hagberg

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:

Crystal structures, cohesion and defects. Reciprocal lattice and waves in crystals. Statistical mechanics and thermal vibration. Free electron model of metals. Energy bands in crystal. Basic phenomena of semiconductors.

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:

Lecture notes (in Finnish). English material for instance parts from books: H.M. Rosenberg: The Solid State, Clarendon Press, Oxford, 1988 and B. Streetman: Solid State Electronic Devices, Prentice Hall, New Jersey, 1995.

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

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:

Junctions. Semiconductor diodes and lasers. Bipolar junction transistors. Field effect transistors. Switching devices.

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:

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:

Lecture notes (in Finnish). Book: Streetman, B.: Solid state electronic devices, Prentice-Hall, New Jersey, 2000 (chapters 5 - 8, 11).

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:

-

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 excerices.

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:

Nilsson, Riedel: Electric Circuits (6th or 7th ed., Prentice-Hall 1996), Chapters 12-18.

Assessment methods and criteria:

Course is examined by a final exam. Obligatory 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:

-

521432A: Electronics Design I, 5 op

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

ECTS Credits:

5

Language of instruction:

Finnish.

Timing:

Spring, period 4. Note: Lectured twice in 2017-2018, in autumn as well, period 1.

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

8. should be able to recount the basic principles governing the functions and properties of emitter-coupled logic

Contents:

Frequency response of a transistor amplifier, differential amplifier, feedback, stability and nonidealities of a feedback amplifier, comparator, output stages and power amplifiers, applications of operational amplifier, oscillators, tuned amplifiers and ECL logic.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 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:

Lecture notes, Razavi: Fundamentals of Microelectronics (John Wiley & Sons 2008), chapters 10-13-8 and 14, partially or Sedra & Smith : Microelectronic Circuits (6th ed.), chapters 7,8,9,13 and partially 11 and 12.

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:

Juha Häkkinen

Working life cooperation:

-

Other information:

-

521404A: Digital Techniques 2, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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 buildning 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:

1. Logical and physical properties of digital logic components. 2. Representation of digital designs. 3. Combination logic design. 4. Sequential logic design. 5. Digital artithmetics. 6. Semiconductor memories. 7. Register transfer level architecture design. 8. Register transfer level modeling and synthesis. 9. Timing design. 10. Digital interface design. 11. Design verification

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.
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:

-

521384A: Basics in Radio Engineering, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Risto Vuohtoniemi, 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 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:

Introduction to radio waves and radio engineering. Fundamentals of electromagnetic fields. Transmission lines and waveguides. Impedance matching. Microwave circuit theory. Passive transmission line and waveguide devices. Resonators and filters. Circuits based on semiconductor devices. Antennas. Propagation of radio waves. Radio system. Applications of radio engineering. Biological effects and safety standards.

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:

3 rd 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. In English: Antti V. Räisänen & Arto Lehto: Radio Engineering for Wireless Communication and Sensor Applications, Artech House, 2003. Additional reading in Finnish: Jyrki Louhi & Arto Lehto: Radiotekniikan harjoituksia. Otatieto, 1995.

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:

-

Other information:

-

521070A: Introduction to Microfabrication Techniques, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Teirikangas, Merja Elina

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 /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, inculding their utilisation and restrictions.

3. Is capable of designing a fabrication process for a simple microelectronics application and is able to indetify 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:

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

521304A: Filters, 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:

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, excercise and design excercise

Learning activities and teaching methods:

30 h lectures, 14 h exercises. A deign 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:

van Valkenburg: Analog Filter Design, 1982, chapters1-14, 18 ja 20 ; or year 2001 edition chapters 1-13.

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:

-

521092A: Electronic Measurement Techniques, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Saarela

Opintokohteen kielet: Finnish

Leikkaavuudet:

521171A	Electronic Measurement Techniques	6.5 op
521171A-01	Electronic measurement techniques, exam	0.0 op
521171A-02	Electronic measurement techniques, exercise work	0.0 op
521430A	Electronic Measurement Techniques	6.0 op

ECTS Credits:

5 ECTS credits / 136 h

Language of instruction:

Course is lectured in Finnish. Lecture notes are available in English. Calculation exercises, laboratory exercises and the exam can be done in English.

Timing:

Period 4

Learning outcomes:

1. can name the electrical measurement technique terminology associated to measurement systems, sensors and buses to candidate level.

2. can plan and implement complicated measurements with oscilloscopes

3. can plan and implement basic measurements with spectrum analyzers

4. can plan and implement basic measurements with light detectors

5. can name common sources of noise and interference

6. name means to control noise and interference

7. can name methods to realize electrical quantities

Contents:

Broad view to electronic measurements.

Mode of delivery:

Pure face-to-face teaching.

Learning activities and teaching methods:

Lectures and calculation exercises 30h, laboratory exercises 16 h and self-study 90h

Target group:

Course is compulsory for most electrical engineering students. Course is open for all students in University of Oulu.

Prerequisites and co-requisites:

Electrical Measurement Principles, Analogue Electronics I, Digital Techniques I.

Recommended optional programme components:

The course replaces previous courses with same name, but different credits and code.

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:

Juha Saarela

Working life cooperation:

None.

Other information:

-

521307A: Laboratory Exercises on Analogue Electronics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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:

Parallel to Electronics Design I.

Recommended or required reading:

Lecture notes of Principles of Ekectronic 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:

-

Supplementary Module: Information Processing Science. (15 ECTS cr)

810136P: Introduction to Information Processing Sciences, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay810136P	Introduction to information processing sciences (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 autumn semester, during period 1. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:

After passing the course, a student will be able to - describe the disciplines of Information Processing Science, - explain the essential Information Processing Science concepts, - name historically significant and current research topics in Information Processing Science, - identify the characteristics and requirements of work tasks in the field of Information Processing, - retrieve, analyse, contest and classify information related to those, as well as - discuss and report in written form on those.

Contents:

The course consists of lectures on disciplines, essential concepts, historically significant and current research as well practical work life in Information Processing Science. In addition, the student will familiarize with scientific work skills by listening, discussing, reading, thinking critically and creatively, retrieving data, classifying and presenting in written form.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Lectures 24 h, exercises 20 h, self-study 89 h

Target group:

BSc students

Recommended optional programme components:

Recommended or required reading:

Lectures, additional material, material searched by students themselves

Assessment methods and criteria:

Exercise tasks

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Henrik Hedberg

811122P: Introduction to Programming, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Räsänen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay811122P	Introduction to Programming (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 autumn semester, during periods 1. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:

After completing the course the student is able to design a programme by splitting main problem into solvable sub problems. • The outcome of design process is modules which she/he is able to write by using chosen programming language. • Student is able to use selection and loop structures to control execution of a module and control execution between modules. • Student is able to use basic data types for saving and processing data and she/he is able to use right operations to this data. • Student is able to use arrays to handle large amounts of same type of data and is able to use control structures to flexibly manipulate the data of arrays. • Student is able to use pointers for example to enhance passing large amount of data between modules and at the same time taking care of the risks of using pointers. • Student is able to use structured data types that contain fields of different data types and is able to manipulate the fields of these data structures. • Student is able to programmatically use files to save permanently large amount of data she/he is able programmatically read data from files for further processing.

Contents:

1. Software design method (waterfall) 2. Problem solving 3. Stepwise refinement 4. Control structures 5. Modular programming, calling
modules, communication between modules 6. Data types 7. Arrays 8. Pointers 9. Character strings 10. Data structures 11. File processing

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40h, home programming assignment 24h, self-study 70h.

Target group:

BSc students

Recommended or required reading:

Course book: 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. Weekly exams and exercise points and home programming assignment.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Ilkka Räsänen

813316A: Business Process Modeling, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

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 3rd spring semester.

Learning outcomes:

After completing the course, students are able to model and design business processes. The student is able to use a computer-based process modeling tool. The student is able to distinguish between business process change on the enterprise level, business process level and the implementation level. The student is able to design process architecture in teamwork with other students.

Contents:

Process architecture and how it can be fitted to the organisation, process modelling, process performance measurement, understanding process-related problems, process development, software tools for modelling and analysing processes, exercises.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 26 h (or exam), exercises 13 h, individual assignments (lecture assignments, small process model, etc.) 34 h, large process model (group work) 60 h

Target group:

BSc students.

Recommended optional programme components:

-

Recommended or required reading:

Harmon, Paul (2007). Business Process Change. A Guide for Business Managers and BPM and Six Sigma Professionals. Morgan Kaufmann Publishers. Additional material to be announced during the course.

Assessment methods and criteria:

This course unit utilizes continuous assessment. Students can either participate in the lectures (min. 85% attendance required) or take the exam. All students will write lecture assigments, and will create a process architecture / model with a software tool. The assessment of the course unit is based on the learning outcomes of the course unit.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Minna Pakanen

Working life cooperation:

No

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

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

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 held in the autumn semester, during period 2. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:

After completing the course, students will be able to examine humans as both users and developers of information technology. The student learns core concepts of the phenomenon, and understands their meaning in relation to practice. Students are also familiar with the background of usability research and some of its scientific theories. Students are able to observe and specify a variety of use situations and user experiences of information technologies. Students also understand the challenges of the information technology developers when targeting to create pleasant use experiences for the users of these technologies. After completing the course, students also realize they have started their own journey to become an expert in information technology development.

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.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures (24 h), home assignments and written task based on required reading (about 106 h).

Target group:

BSc students.

Recommended or required reading:

Antti Oulasvirta (ed.): "Ihmisen ja tietokoneen vuorovaikutus" (2011), osat I ja II. In addition, the material during lectures and other supplementary material.

Assessment methods and criteria:

Pre-assignment, home assignments, individual essay, and optional advanced assignment.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Tonja Molin-Juustila

811375A: User Interface Programming, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Lappalainen, Jouni Esko Antero

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

Finnish

Timing:

3 rd year, autumn semester, periods 1 + 2

Learning outcomes:

After completing the course, the student can implement a software application that has a graphical user interface. The GUI (as well as the entire application) must be developed by implementing usability design principles from the beginning of the development process.

Contents:

User interface elements, foundations of user interface libraries, user interface design principles, user interface layout, the relationship between user interfaces and software architectures, event-driven programming, web usability, web user interfaces, web programming.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Exercise 24h, coursework 75h, independent study 35h.

Target group:

BSc students

Prerequisites and co-requisites:

Knowledge and skills of the course “811380A Basics of Databases” and fundamentals of user interface design. In addition, the knowledge and skills of object-oriented programming are needed.

Recommended optional programme components:

Recommended or required reading:

Provided reading material during the course. In addition, Lauesen, S. 2005. User Interface Design: A Software Engineering Perspective.

Assessment methods and criteria:

The student must submit coursework that fulfils the given requirements (defined during the course). Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Jouni Lappalainen

Working life cooperation:

No

811379A: Basics of Human Computer Interaction, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Netta Iivari

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 student’s work

Language of instruction:

Finnish

Timing:

2nd year, period 3, bachelor level.

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.

Mode of delivery:

Face-to-face teaching, self-study.

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 (3h) individual tasks (31 h).

Target group:

2nd year, bachelor level students.

Prerequisites and co-requisites:

Humans as Users and Developers of Information Technology (811177P) -course or related knowledge.

Recommended optional programme components:

Recommended or required reading:

Dix et al. (2004, third or later edition) *Human-Computer Interaction* and lecture and assignment materials.

Assessment methods and criteria:

During the course, the students will be compiling the group assignments and 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:

1–5, fail

Person responsible:

Netta Iivari

Working life cooperation:

No

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: Juustila, Antti Juhani

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

Finnish

Timing:

3 rd year, periods 3-4

Learning outcomes:

The goal of the course is to give the students an overview of the concepts and techniques related to software architectures. The focus of the architectural solutions is in the object oriented systems, but the course addresses also generic architectural models and techniques supporting architectures. After the course, the student is able to identify and analyse different architectural solutions and understands the pros and cons of these, from the perspective of building and running software, as well as from the viewpoint of quality and maintainability. The student is albe to describe architectural solutions and elements of these, as well as different interfaces, using the modeling techniques of UML. The student is able to create alternative architectural solutions based on functional and non-functional requirements, using different design methods and techniques of architectural design, as well as evaluate the solutions' fit to use. The student is able to differentiate the design of product and producet family architectures from the design of more usual software architectures.

Contents:

The fundamentals of software architectures. Documenting software architectures. Components and interfaces, Software dependencies. Design
patterns. Architectural styles. Product line architectures. Frameworks, Evaluation methods of software architectures.

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 knowledge of the software development process in general, the basics of UML in modelling, introductory experience in object oriented
programming (e.g. courses 811335A 34 of 104 15.08.2016 11:37 Ohjelmistotekniikka, 812346A Oliosuuntautunut analyysi ja suunnittelu, 812347A Olio-ohjelmointi). Recommended previous course is the Olio-ohjelmoinnin jatkokurssi.

Recommended optional programme components:

Advanced Object-oriented Programming is a recommended prerequisite.

Recommended or required reading:

Robert Hanmer: Pattern-Oriented Software Architecture For Dummies, 2013; K. Koskimies, T. Mikkonen: Ohjelmistoarkkitehtuurit. Talentum
2005; L. Bass, R. Clements, R. Kazman: Software Architecture in Practice. Addison-Wesley 2003; Other material mentioned in the course.

Assessment methods and criteria:

The evaluation of the course is based on the learning outcomes of the course. The course is passed by participating in the course assignments as well as by evaluation of the exercise work. Detailed evaluation principles are announced in the wiki page of the course.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Antti Juustila

Working life cooperation:

No

Other information:

Course is potentially implemented in cooperation with the Tampere university of technology.

811174P: Introduction to Software Business, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: 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 4. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:

After completing the course, a student can:
- 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.

Contents:

This course provides an overview of software business from three different viewpoints: software industry, business logic, and functions of a software company. The course topics include history of software business, structuring and clusters of software industry, business models in software industry, networking and outsourcing, growth and development of a software company, software marketing and sales, and internalization of a
software company.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 26-30 h, exercises 20 h, independent work 54-58 h, take home examination 30 h

Target group:

BSc students.

Recommended optional programme components:

-

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

812341A: Object-Oriented Programming, 5 op

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

ay812341A	Object-oriented Programming (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.

Learning outcomes:

• After completing the course, the student is able to explain the general objectives and techniques of object-oriented programming paradigm. • Furthermore, the student can describe the practical meaning of concepts of object-oriented programming. • The student can construct Java programs that apply inheritance, composition, and polymorphism.

Contents:

Introduction to object-orientation, Basics of programming in Java language, Composition, inheritance and polymorphism, Java collections and exception handling.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 32 h, laboratory exercises 21 h, weekly assignments and independent work 82 h

Target group:

BSc students.

Prerequisites and co-requisites:

Course Introduction to Programming or similar knowledge.

Recommended or required reading:

Timothy Budd: Introduction to object-orientedprogramming, 3rd edition.
Bruce Eckel: Thinkingin Java 3rd edition or later.

Assessment methods and criteria:

Weekly assignments (preferred) or final exam + programming assignment.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Ilkka Räsänen

812342A: Object Oriented Analysis and Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay812342A	Object Oriented Analysis and Design (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

Finnish. If at least four non-Finnish students take the course, an English exercise group will be organised.

Timing:

The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd autumn semester.

Learning outcomes:

After completing the course, the students know possibilities of UML-language family to describe different views. They can picture a task using Use
cases and scenarios. Moreover they can produce detailed descriptions using activity-, class-, interaction- and state diagrams. They know
principles of object-orientedness and can use abstract as well interface classes. Additionally they can model user interface by state diagrams. They
understand what design patterns are and how they are described and categorised.

Contents:

Principles of object orientation and object-oriented programming; quality criteria of object orientation; design patterns; case use; activity, class, interaction and state machine diagrams; class realisation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures (in Finnish) 30h, exercises and assignments 28h, independent work 85 h

Target group:

Bachelor students.

Prerequisites and co-requisites:

Elementary course of object-oriented programming is a compolsory prerequisite. Basic knowledge of object programming and information systems analysis and design are assumed.

Recommended or required reading:

Bennet, McRobb & Farmer: Object-oriented systems analysis and design, Using UML.

Assessment methods and criteria:

Examination. At least 50% on points needed for passing the course.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Juha Iisakka

812305A: Information Systems in Organisations, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

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 2. It is recommended to complete the course in the 1st study year.

Learning outcomes:

After completing the course, the student: -is able to explain the importance of information systems in organizations, -is able to define the conditions for the successful operation of the information in the organization, -is able to explain the main features of the development of information systems.

Contents:

The basics issues of organization, structure, and operation, the basics of a digital organization, information types and roles of the organizations,
interaction between information and organization, the role of information systems in the management of organizations and decision-making, formation of organizational knowledge and management, enterprise resource planning (ERP) systems, organizational reform of information systems and the economic importance of information systems.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 20 h, independent study of the course literature, weekly tasks and scientific essay 110 h.

Target group:

BSc students.

Recommended or required reading:

Lectures and Wallace, Patricia: Information Systems in Organizations, People, Technology, and Processes. Pearson 2013.

Assessment methods and criteria:

Active participation in lectures. Weekly tasks and scientific essay.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Kaisu Juntunen

811167P: Introduction to Information Systems Design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Information Processing Science DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Mikko Rajanen
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay811167P	Introduction to Information Systems Design (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 2nd spring semester.

The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st study year.

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:

Basic concepts of Information Systems, Information System Design, Information System Modeling, Operational Environment Modeling, Process models for Information System Development, Evaluation of Information Systems

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 27 h, exercises 21 h, assignment 85 h, exam 3 h.

Lectures (27h), Exercises (21h), Assignment (85h), Exam (3h).

Target group:

BSc students.

Recommended or required reading:

Satzinger, Jackson ja Burd (2007), Systems Analysis and Design in a Changing World. Hoffer, George and Valacich (2008), Modern systems Analysis and Design, 5. painos.

Assessment methods and criteria:

Exam and mandatory assignment.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Mikko Rajanen

812332A: Information Systems Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Pasi Karppinen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 133 hours of work.

Timing:

The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 3rd autumn semester.

Learning outcomes:

After completing the course, the student is able to understand the link between information system design and organizational development, and to
apply such a system design method in an organizational context.

Contents:

During the course the students complete a group exercise (typically in groups of 4 persons) using Contextual Design method and its design stages
that lead to actual information systems implementation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 24 h, exercises 18 h, seminar 12 h.

Target group:

BSc students

Prerequisites and co-requisites:

Prerequisites are 811169P Introduction to Information Systems Design and 812346A Object Oriented Analysis and Design.

Recommended or required reading:

Beyer, H. Holtzblatt, K. (1998): Contextual Design: Defining Customer-Centered Systems. San Francisco: Morgan Kaufmann Publishers, Inc.

Assessment methods and criteria:

The course is normally completed as group work, and the output is presented in a course seminar. The work follows the stages of Contextual Design method and the exercise assignments support the completion of the course work. Course work reports are presented and reviewed in a final
seminar. In special circumstances the course can also be completed as individual work.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Pasi Karppinen

811394A: Database systems, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

Finnish, no possiblity for non-Finnish to pass the course.

Timing:

The course is held in the spring semester, during period 4. It is recommended to complete the course in the 2nd study year.

Learning outcomes:

The students have knowledge of some modern database principles - such as non-relational database structures. Moreover, after completing the course, students have constructed a small object-relational database application.

Contents:

Modern database solutions and the use of them. Realational database application, Object- and XML extensions in relational databases.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures and seminars 41h, computer exercises 54, self-study 32h.

Target group:

Bachelor students.

Prerequisites and co-requisites:

Basics of database -course (such as 811380A) and Object oriented analysis and design course (such as 812346A) are compolsory prerequisities.

Recommended or required reading:

Will be announced in lectures.

Assessment methods and criteria:

Will be anounced in lectures.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Juha Iisakka.

811395A: Basics of Databases, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

Finnish. If at least four non-Finnish students take the course, an English exercise group will be organised.

Timing:

The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester.

Learning outcomes:

In addition, they have knowledge of modern non-relational database solutions (such as data warehouses and NoSQL-databases) and they have
commanding knowledge of making use of those non-relational databases (such as data mining and Big data techniques).

Contents:

Conceptual modelling (ER- and EER-diagrams), relational model (theory, databases, query techniques and normalization), transactions.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 45 h (in Finnish), compulsory exercises 24 h, reading 20 h, exams 21 h and self-studying 23 h

Target group:

Bachelor students

Prerequisites and co-requisites:

The student knows basics of programming.

Recommended or required reading:

Silberschatz, Korth & Sudarshan: Database system concepts. Elmasri & Navathe: Fundamentals of database systems.

Assessment methods and criteria:

The course is divided to five parts. All parts must be passed in a year. Students must show they achieve at least half of required knowledge of each part.

Grading:

fail, 1-5

Person responsible:

Juha Iisakka

810122P: Computer Architecture, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Räsänen

Opintokohteen kielet: Finnish

Leikkaavuudet:

521267A	Computer Engineering	4.0 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.

Learning outcomes:

After completing the course, students understand and manage the building blocks of computer architectures, the execution and performance of computer platforms as well as activities related to performance, resource needs, and error situations. Students master the basic vocabulary, which is required in communication and documentation in software development, particularly in the close to device level applications such as embedded software, mobile systems, multimedia and scientific computing.

Contents:

Basics of digital logic and components of a processor Formats of digital information The processor and its functions The processor instruction set Assembly language Memory management Input and output Interrupts, device drivers and BIOS Multimedia support Mobile processors Parallel computing.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, home exercises 15 h, laboratory exercises 15 h, examination either through two intermediate exams (preparation 65 h) or through final exam (preparation 65 h).

Target group:

BSc students.

Recommended or required reading:

Comer, D.E., Essentials of Computer Architecture. Pearson/Prentice Hall. ISBN 0-13-106426-7. 2005. 369 s. Luennoilla esimerkkejä kirjoista: Tanenbaum A.S., Structured Computer Organisations. 4 thEdition. Prentice Hall. 1999. 700 s. Stallings, W., Computer Organization and Architecture. 5 th Edition. Prentice Hall. 2000. 768 s.

Assessment methods and criteria:

Exam and assignments.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Markku Oivo.

811168P: Information Security, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Mari Karjalainen

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 4. It is recommended to complete the course in the 2nd spring semester.

Learning outcomes:

After completing the course a student is able to define essential information security concepts, is aware of the common types of security threats, and their managerial and technical protection mechanisms. The student recognizes the different phases of secure systems development and can describe the fundamental characteristics of risk management. The student gets familiar with basics of technical information security methods and cryptography.

Contents:

1. Basic concepts of information security 2. Information security threats, vulnerabilities, and risks 3. Legal issues and information security frameworks 4. Risk management 5. Cryptography 6. Security technologies 7. Behavioral information security research

Mode of delivery:

Face-to-face-teaching

Learning activities and teaching methods:

Lectures and related quizzes/final exam 26 h, weekly assignments and scientific essay 107 h

Target group:

Recommended optional programme components:

Recommended or required reading:

Lecture materials, selected articles, and books: Whitman & Mattord (2015). Principles of information security; Pfleeger et al. (2015): Security in Computing

Assessment methods and criteria:

Lecture tasks, weekly assignments, exam, essay

Grading:

Numerical scale 1-5

Person responsible:

Mari Karjalainen

811391A: Requirements Engineering, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Jouni Markkula

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 autumn semester, during period 2. It is recommended to complete the course in the 3rd autumn semester.

Learning outcomes:

After completing this course, the student can analyse the requirements from the problem-domain and solution-domain viewpoints, and understands the special issues associated with these viewpoints. The student can distinguish the roles of problemdomain
and solution-domain requirements for the customer and developer; he/she is able to identify various project types and knows which requirement
style fits best to each project type. The student will be familiar with various requirement definition styles together with their pros and cons, and is able to use some of the most important definition styles. Several requirements of elicitation techniques will be added to the student's toolbox with the skills of mastering some of them. The principles of requirements management, validation and verification during the product life cycle will be familiar to the student at the end of this course.

Contents:

Concepts of problem and solution domain. Requirements in different use contexts. Description styles for functional and non-functional
requirements. Validation and verification of requirements. Requirements negotiation and prioritisation. Release planning. Requirements
management during the product life cycle.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 32 h, weekly assignments and project assignment about 102 h.

Target group:

BSc students

Prerequisites and co-requisites:

We assume the basic skills from the following courses: 811169P Introduction to Information System Design, 812346A Object-Oriented Analysis
and Design, 811380A Basics of Databases, 811335A Software Engineering and 812334A Information Systems Planning.

Recommended optional programme components:

Recommended or required reading:

S. Lauesen, Software Requirements – Styles and Techniques. Pearson Education 2002; chapters 1–4 and 6–9. A.M. Davis, Just Enough Requirements Management, Dorset House Publishing 2005; parts. Lecture slides.

Assessment methods and criteria:

Two ways of passing: 1) Active participation: weekly assignments and project assignment (only for Finnish-speaking students); 2) Conventional
exam

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Jouni Markkula

Working life cooperation:

No

Supplementary Module: Industrial Engineering and Management (15 ECTS cr)

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

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Majava

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:

Periods 1-2.

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:

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

Learning activities and teaching methods:

Web-based lectures 20 h / exercises 18 h / self-study 96 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:

Lecture and exercise materials. Heizer, J. & Render, B. (2014) Operations management: sustainability and supply chain management, 11th ed. Pearson. In addition, recommended materials include Martinsuo, M. et al. (2016) Teollisuustalous kehittyvässä liiketoiminnassa chapters 7-9, 16 and 26.

Assessment methods and criteria:

This course utilises continuous assessment. During the course, there are nine mandatory weekly assignments. At least half of the assignments must be passed.

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 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

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi Aaltonen

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. English material may also be used.

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 includes555225P 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:

Assignments, exercise book and exam. The course grading is based on the exam. Well completed assignments and exercise book may raise grading.

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 courses 555280P Basic Course of Project Management + 555282A Project Management.

555242A: Product development, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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

Ei opintojaksokuvauksia.

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:

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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:

Oakland, J.S. (2014) Total quality management and operational excellence (4th ed.). Routledge, 529 pp. 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.

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

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: 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.

Timing:

Periods 3-4.

Learning outcomes:

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

- use the central concepts related to well-being at work, can set targets for it, and is able to choose appropriate methods from the management and personal career point of views
- develop well-being at work in the contexts of labor legislation, good practices, productivity, occupational safety expertise, management and human resources
- utilise basic knowledge, search for more information and knows the key players in the field
- know the key sources of information, typical goal-setting and management practices and the methods for assessing the performance of an individual employee, supervisor, company and entrepreneur
- know the basics how to assess the impact of well-being at work from the economic perspective, 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 for the work community he/she leads - and for himself/herself as an employee or a supervisor. 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 22 h / self-study 100 h / group work & exercises 12 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. Strategisen 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 %), seminar 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.

Supplementary Module: Working life & Entrepreneurship (15 ECTS cr)

A631401: Entrepreneurship, Basic Studies, 25 op

Opiskelumuoto: Basic Studies
Laji: Study module
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Choose five of the following courses (25 ECTS)

724811P: Entrepreneuring for Tomorrow, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Anne Keränen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

English

Timing:

Period B

Learning outcomes:

Students develop skills for creative problem solving; students understand that entrepreneurial behavior can take place within many contexts (new ventures, associations, government agencies, and existing businesses); students are able to recognize and analyze business opportunities and social problems.

Contents:

The course outlines interdisciplinary skills that foster the creation of an entrepreneurial mindset. These skills include problem solving, creativity, networking, communications, risk-taking and adaptability. Entrepreneurship is approached through its different forms and roles in society. The focus is on entrepreneurial mindsets and what entrepreneurship requires from individuals and teams, especially from the “me/us as entrepreneur” standpoint. During the course students familiarize themselves with the role of business in society.

Mode of delivery:

Blended study methods including workshopping, face-to-face teaching, coaching and online assignments.

Learning activities and teaching methods:

Learning takes place by means of intensive lectures, visitor presentations and discussions, workshops and exercises both in class and in different places with real life entrepreneurship professionals.

Target group:

University students

Prerequisites and co-requisites:

No

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:

Articles and course specific material.

Assessment methods and criteria:

Assessment is based on learning diary type reflection reports prepared by the student based on course materials, lectures and meetings with entrepreneurship professionals.

Grading:

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

Person responsible:

Jan Hermes, Petri Ahokangas and Anne Keränen

Working life cooperation:

The course includes real life case examples and meetings with entrepreneurship practitioners. Students learn interdisciplinary skills that can be applied in real work life.

Other information:

no

724812P: Building Change Through Entrepreneurship, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

ay724812P	Building Change Through Entrepreneurship (OPEN UNI)	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

English

Timing:

Period C

Learning outcomes:

Students (1) understand the key terms, concepts and processes of entrepreneurship, (2) are able to analyze the feasibility and viability of a business opportunity, (3) know how to create a start-up, (4) understand the elements of marketing of a start-up, (5) know how to build a team and lead a start-up and (6) are able to reflect on the ethical and social impact of entrepreneurship.

Contents:

Introducing entrepreneurship, discovering opportunities, business planning, effective business model, ethical and social foundation, financial viability, acquiring financing, marketing issues, building a team, preparing for growth, strategies for growth

Mode of delivery:

Face-to-face teaching and coaching

Learning activities and teaching methods:

16 hours of lectures with reflection of lectures, 20 h workshops and preparing for the workshops, writing the assignment reports. The course includes lectures, study group work and individual work. In addition, the students are required to independently read course literature and prepare for the assignments (98 hours). Further details will be provided by the responsible persons in the first session.

Target group:

University students

Prerequisites and co-requisites:

No

Recommended optional programme components:

No

Recommended or required reading:

Barringer, B. & Ireland. D. (2012). Entrepreneurship: Successfully Launching New Ventures, 4 th Edition. Prentice Hall.

Assessment methods and criteria:

Assessment will be based on the presence in the lectures, study group work and individual assignments.

Grading:

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

Person responsible:

Vesa Puhakka and Anne Keränen

Working life cooperation:

The course includes workshops coaching on new business creation. In the workshops are analyzed real-life situations, designed solutions and practiced new business creation skills.

Other information:

No

724813P: Entrepreneurship in Action, 5 op

Voimassaolo: 01.08.2017 - 31.12.2020

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Niina Karvinen

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

English

Timing:

Periods A-D

Learning outcomes:

Upon completion of the course, the students are able to apply the core competencies of his/her studies in a real life entrepreneurship context. Students are able to realize and start working with a business opportunity or social problem in practice to find a solution. The student will improve his/her entrepreneurial skills; multicultural group working, problem solving, communicating and presenting. Students choose one of the Business Kitchen’s Programmes; Demola, Avanto Accelerator or Arctic Business Corridor to entrepreneurship in action course.

Contents:

In these studies students generally co-operate in workshops where they learn practical methods of entrepreneurship like business model creation and validation processes, lean methodology, marketing, branding, basic financial management and presenting ideas e.g. pitching.

Mode of delivery:

Face-to-face teaching and coaching.

Learning activities and teaching methods:

Bootcamps, workshops, group work, individual guidance. Most of the exercises are completed as group work (132 h).

Target group:

University students

Prerequisites and co-requisites:

No

Recommended optional programme components:

No

Recommended or required reading:

Materials vary according to the programme

Assessment methods and criteria:

Programme specific assessment that may include both group and individual assessment methods.

Grading:

The course utilizes grading scale “pass/fail”

Person responsible:

Minna Törmälä and Anne Keränen.

Working life cooperation:

The programs of this course are run in close co-operation with relevant business partners or applied to practice. Students also learn practical entrepreneurship skills.

Other information:

The number of students is limited

724814P: Introduction to Business Development, 5 op

Voimassaolo: 01.08.2017 - 31.07.2021

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Antti Muhos

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

English

Timing:

Period A

Learning outcomes:

Students are familiar with basic business concepts and theories in SME context. On successful completion of the course, students understand the business development process from opportunity recognition to a launch and development of a sustainable business. The students are able to identify basic business processes in practice.

Contents:

The course focuses on the basic concepts of SME business management and development including opportunity recognition, experimentation and testing of a new business idea, strategy, business model development and business planning, financing and planning and management of growth and change.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Face-to-face teaching including lectures, guest lectures, company visit/s and variable action-based learning methods (36h). Individual assignment (20h) and reading of course materials (76 h).

Target group:

Open to all.

Prerequisites and co-requisites:

No

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:

Selected readings from e.g.: Spinelli & Adams. 2012, 2016. New Venture Creation: Entrepreneurship for the 21st Century. McGraw-Hill, New York. Allen, K. 2012. New venture creation. South-Western. Moreover, additional materials are provided during the course.

Assessment methods and criteria:

Learning diary, group assignment/s

Grading:

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

Person responsible:

Adjunct professor Matti Muhos

Working life cooperation:

This course is designed as an integral part of entrepreneurship studies. This course will include real life case studies of established and emerging businesses by company visits.

Other information:

No

724815P: Entrepreneurial Assignment, 5 op

Voimassaolo: 01.06.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Sari Perätalo

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

English

Timing:

Free. The schedule for the course is agreed on the individual basis.

Learning outcomes:

Upon completion of the course the students are familiarized with entrepreneurial activity in society and possess skills that help to solve entrepreneurial problems and make change. Students will have an insight into the diversity of entrepreneurship and gain understanding of the specific aspects of entrepreneurship.

Contents:

Studies are individually tailored upon acceptance by the course instructor. Students compile the course through participating in diffenrent entrepreneurship supporting activities. The students can for example participate in TellUs Innovation Arena boot camps, events or volunteering program. In addition students can include activities organized by other stakeholders (e.g. faculties, public organizations or third sector organizations). In addition, the students reflect their learning in a report.

Mode of delivery:

Face-to-face

Learning activities and teaching methods:

Individual and group work (132h). Teaching methods vary depending on the entrepreneurial project, event, workshop, etc. a student has participated in.

Target group:

University students

Prerequisites and co-requisites:

Student should have completed 724813P Entrepreneurship in action -course before taking this course.

Recommended optional programme components:

The course does not require additional studies carried out at the same time.

Recommended or required reading:

Reading materials are agreed individually with the responsible person.

Assessment methods and criteria:

Assessment is based on an individual report that a student is expected to deliver after participating in an entrepreneurship-related event, workshop, project, etc.

Grading:

The course utilizes verbal grading scale “pass/fail”.

Person responsible:

Irina Atkova

Working life cooperation:

The course allows the students to gain first-hand entrepreneurial experience in various forms.

Other information:

No

724816P: Building Business Through Creativity and Collaboration, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Anne Keränen
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

English

Timing:

Period B

Learning outcomes:

Upon completion of the course, the student will be familiarized with concepts of learning, collaboration, creativity and emotions. The student will explore entrepreneurship from the perspective of artistic process, experience and learn the process of artistic creation in teams, experience and analyze emotions, such as uncertainty, frustration, enthusiasm and joy alone and in teams. The students will produce a piece of art as an outcome of the course workshops, and organize and host an art exhibition together.

Contents:

The method of this course is based on studio pedagogy. In practice the course employs creative collaborative methods to learn and experience entrepreneurship through art. This process enables outside of the -box thinking, creative propositions and getting to know multidisciplinary team members through concrete learning -by doing approach. Art is used as an illustration, as materials for case studies, and as a place to work and develop business oriented thinking. The art world is a new 2 metaphor to describe our economy based on innovations and digitalization. The participants will learn a creative mindset and bonding of closer ties in teams. More information from the concept behind the course can be found from http://improbable.strikingly.com/

Mode of delivery:

Face-to-face sessions and workshops

Learning activities and teaching methods:

Producing a piece of art and presenting it in an exhibition together with others (36 hours). Reflecting the learning experiences in a personal learning diary during the course (30 hours). Reading course materials (66 hours).

Target group:

Open to all

Prerequisites and co-requisites:

No

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 provided during the course

Assessment methods and criteria:

Compulsory participation and commitment to the teamwork. Learning diary assessment.

Grading:

The course utilizes verbal grading scale “pass/fail”

Person responsible:

Johanna Bluemink

Working life cooperation:

Students learn practical entrepreneurial skills through artistic process.

Other information:

The number of students is limited

Supplementary Module: Economics and Management (15 ECTS cr) (The module is intended only for students of Applied Computing (in MSc).)*

724103P: Strategic Management, 5 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Sari Laari-Salmela, Anniina Rantakari
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay724103P	Strategic Management (OPEN UNI)	5.0 op
721519P	Business Management	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits / 133 hours of work

Language of instruction:

Finnish

Timing:

Period A (2nd year).

Learning outcomes:

After the course students understand the purpose of the different schools of strategic management and recognize the role of the represented viewpoints in organizations' strategy formation. Students are able to define the core concepts of strategic management and analyze the relations between strategy, markets and operations.

Contents:

The course aims at analyzing how we could model organizational change processes involving genuine uncertainties, and, at the same time, model individuals and organizations as being able to make strategic choices. The purpose of this course is twofold: First, the aim is to introduce the basic concepts, historical developments and schools of strategic management. Second, the course explores the contemporary developments in strategic thinking.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Intensive contact learning with 18 hours of functional lectures with reflection (54 h) and with 18 hours of workshop sessions with cases (54 h). In addition, the students are required to independently read the course literature and prepare for the workshops (25 h). Further details will be provided by the responsible person in the first session.

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier module (introduction to business studies)

Recommended optional programme components:

This course is part of "Business Processes" -module

Recommended or required reading:

Johnson, G., K. Scholes & R. Whittington. Exploring corporate strategy (Prentice Hall);

Mintzberg, H., B. Ahlstrand & J. Lampel. Strategy safari: the complete guide through the wilds of strategic management (Prentice Hall/Financial Times);
Article collection.

Assessment methods and criteria:

Assessment will be based on group assignment and individual assignments based on the criteria presented during the course.

Grading:

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

Person responsible:

Sari Laari-Salmela and Anniina Rantakari

Working life cooperation:

The course develops abilities in reflective and critical thinking and writing. These skills form the core in strategic thinking. Making learning and thinking visible enables the activities of both oneself and the organization to be examined critically and developed.

Other information:

The number of students is limited.

724105P: Management Accounting, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Kristiina Henttu-Aho

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 / 133 hours of work

Language of instruction:

English (course is lectured separately in Finnish and in English).

Timing:

Period A (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, 16 h exercises and independent reading of study materials (97 hours).

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier module (introduction to business studies)

Recommended optional programme components:

This course is part of "Business Processes" -module

Recommended or required reading:

Drury, C.: Management and cost accounting, 7th or 8th ed. Cengage Learning EMEA. Chapters 1-11 (8th ed.);
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:

Professor in Management Accounting.

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.

724106P: Principles of Marketing, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Nätti

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay724106P	Principles of Marketing (OPEN UNI)	5.0 op
ay721409P	Principles of Marketing (OPEN UNI)	5.0 op
721409P	Firm in the Network Contexts	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits / 133 hours of work

Language of instruction:

Finnish

Timing:

Period C (1st year).

Learning outcomes:

Upon completion of this course, students are able to define the role of marketing in the organization, likewise define basic concepts of marketing (customer perceived value, value creation process, value-based market analysis and strategy, segmenting, targeting and marketing mix, for example). After completing this course, the student is able to differentiate variety of marketing logics in variety of contexts (for example, differences between consumer marketing and B-to-B marketing). The student is able to use concepts of marketing to aid decision making and evaluate the suitability of these decisions from customer viewpoint.

Contents:

During the course, following themes will be discussed: 1) Basic concepts and phenomena: e.g., value creation in customer relationships and marketing in different contexts, 2) Strategic tools of marketing and latest trends 3) Basics of consumer behavior, 4) Marketing and sustainable development, 5) B-to-B marketing and sales, 6) integrated marketing communications, 7) Digital marketing, 8) Distribution channels.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

36 hours of lectures and visiting lecturer presentations, group-based business simulation and related group´s learning diary (20h), independent reading of the textbook and articles (77 h). This course can be passed by doing weekly learning assignments OR an 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:

Kotler, P & Armstrong, G. (2013), Principles of marketing, 15^{th} ed.

Assessment methods and criteria:

Group work (business simulation) and exam OR weekly learning assignements.

Grading:

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

Person responsible:

Professor of Marketing Satu Nätti and Doctoral Student Outi Keränen.

Working life cooperation:

Upon completion of this course, the student recognizes the meaning of customer-orientation in organizations and in one´s individual actions and professional development. Group work (business simulation) gives wide view on organization entity and activities, likewise understanding of the link between decision making, customer experience and consequent profitability of organization.

Other information:

The number of students is limited.

724109P: Investment Decisions, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Mirjam Lehenkari

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay724109P Investment Decisions (OPEN UNI) 5.0 op

ay721178P Fundamentals of Corporate Finance (OPEN UNI) 5.0 op

721178P Principles of Corporate Finance 5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits / 133 hours of work

Language of instruction:

Finnish

Timing:

Period B (2nd year)

Learning outcomes:

The course is an introduction to the theory and practice of capital budgeting. Upon successful completion of the course, the student will be able to evaluate the profitability of an investment project using various capital budgeting techniques.

Contents:

1) the most common capital budgeting techniques, 2) determining the appropriate discount rate for a project, 3) scenario and sensitivity analyses, 4) capital budgeting in practice

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (36 h), self-study (94 h), exam (3 h)

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier module (introduction to business studies)

Recommended optional programme components:

This course is part of "Business Processes" -module

Recommended or required reading:

Ross, Westerfield & Jordan: Fundamentals of Corporate Finance (4th or later edition) / Corporate Finance Fundamentals, Irwin/McGraw-Hill

Assessment methods and criteria:

Faculty examination

Grading:

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

Person responsible:

Postdoctoral researcher Mirjam Lehenkari

Working life cooperation:

Upon successful completion of the course, the student will be able to apply the tools that financial managers need when making their investment decisions.

Other information:

The number of students is limited.

724110P: Introductory Economics, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: 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	Principles of Economics	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits / 133 hours of work

Language of instruction:

Finnish

Timing:

Period A. It is recommended that students complete the course during the first autumn semester.

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 Finnish economy and also the European economy.

Contents:

The course introduces students to the tools and ideas economics uses to describe and explain economic phenomena. The topics include:

- the long-term development of the Finnish and World economy
- 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
- monetary and fiscal policy
- economic growth

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

36 lectures including 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 (2)or Final exam (3 h).

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: Acemoglu, D., Laibson D. and List, J.A., Economics, 2015
and extra readings: Timothy Taylor, The Instant Economist. Everything You Need to Know About How the Economy Works. 2012. A Plume Book (Penguin), New York NY.
Robert P. Murphy, Lessons for the Young Economist. Ludvig von Mises Institute 2010; http://mises.org/books/lessons_for_the_young_economist_murphy.pdf

Assessment methods and criteria:

Final Exam.

Grading:

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

Person responsible:

University lecturer 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.

Statistics

805351A: Linear Regression, 5 op

Voimassaolo: 01.06.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Läärä Esa

Opintokohteen kielet: Finnish

Leikkaavuudet:

806359A	Regression modelling	10.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish

Timing:

2nd or 3rd year during B.Sc. studies

Learning outcomes:

After successful completion of the course the student can describe basic concepts and assumptions in linear models for continuous outcome variables as well as main principles of regression modelling, and can also apply these methods in analysis of experimental and non-experimental observation data.

Contents:

Linear regression models for a continuous outcome variable; formulation of the model, selection of variables and interpretation of parameters; fitting the models, estimation of parameters and prediction using method of least squares; model criticism and diagnostics; use of R environment and SAS software in modelling.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (28 h), practicals and computer classes (14 h) and independent work.

Target group:

Students having statistics as the major or a minor subject.

Prerequisites and co-requisites:

Basic Methods of Data Analysis; Core courses in the B.Sc curriculum of mathematical sciences.

Recommended optional programme components:

Prerequisite to the course Generalized Linear Models

Recommended or required reading:

Weisberg, S. (2014). Applied Linear Regression, fourth edition, Hoboken NJ: John Wiley.

Assessment methods and criteria:

Active participation in practicals and final exam. Read more about assessment criteria at the University of Oulu webpage

Grading:

Fail, 1-5

Person responsible:

Esa Läärä

Working life cooperation:

No

Other information:

-

805350A: Estimation and Test Theory, 5 op

Voimassaolo: 01.06.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Läärä Esa

Opintokohteen kielet: Finnish

Leikkaavuudet:

805310A	Statistical Inference I	10.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish

Timing:

2nd or 3rd year during B.Sc. studies

Learning outcomes:

After successful completion of the course the student can describe the basic principles of frequentist and bayesian statistical inference, compute point and interval estimates, test statistics and P-values based on likelihood function of models with few parameters, and interpret results thus obtained.

Contents:

Statistical model and observational data; construction and properties of point estimators and confidence intervals; likelihood ratio, score and Wald test statistics and their asymptotic sampling distribution; jackknife and bootstrap methods; elements of bayesian inference; use of R environment in inferential problems.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (28 h), practicals and computer classes (14 h), and independent work

Target group:

Students having statistics as the major or a minor subject

Prerequisites and co-requisites:

Likelihood inference, Introduction to probability theory I, Basic Methods of Data Analysis

Recommended optional programme components:

Needed in nearly all intermediate and advanced courses of statistics

Recommended or required reading:

Migon, H.S., Gamerman, D., Louzada, F. Statistical Inference: An Integrated Approach, Second Edition. Chapman & Hall/CRC, 2014; Pawitan, Y: In All Likelihood: Statistical Modelling and Inference Using Likelihood, Oxford, 2001; Sprott, D. A.: Statistical Inference in Science, Springer, 2000; Kalbfleisch, J.G.: Probability and Statistical Inference, volume 2: Statistical Inference, Second Edition, Springer, 1985.

Assessment methods and criteria:

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

Grading:

Fail, 1-5

Person responsible:

Esa Läärä

Working life cooperation:

No

Other information:

-

805353A: Statistical Software, 5 op

Voimassaolo: 01.06.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mathematics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

805340A	Statistical Software	4.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish

Timing:

3. year studies. Fall semester. Timing varies.

Learning outcomes:

After successful completion of the course the student can use independently major statistical software needed in data analysis.

Contents:

The course covers R, SAS and IBM SPSS, and their most important tools for data management, statistical computation, graphics and programming will be introduced and proficiency for their fluent use is acquired.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

42 h lectures, exercises and tutoring. 88 h learning tasks and self-study.

Target group:

Major and minor students

Prerequisites and co-requisites:

806112P Basic methods of data-analysis

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes

Assessment methods and criteria:

Home works and/or exam

Grading:

Numerical grading 1-5 (or fail)

Person responsible:

Hanna Heikkinen

Working life cooperation:

No

805349A: Likelihood and Bayesian Inference, 5 op

Voimassaolo: 01.06.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Läärä Esa
Opintokohteen kielet: Finnish
Leikkaavuudet:

805310A	Statistical Inference I	10.0 op

Ei opintojaksokuvauksia.

805306A: Introduction to Multivariate methods, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Jari Päkkilä
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Basic Business Studies

A635801: Basic Business Studies, 25 - 40 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Study module
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Student can select individual courses or complete the whole minor (minimum 5 courses, 25 ECTS).

724830P: Introduction to Accounting and Financial Management, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS - 133 hours of student's work.

Language of instruction:

Finnish.

Timing:

January-February 2018.

Learning outcomes:

After completing the course, the student will be able to:
- understand the role of accounting in organizations and society
- know the content and structure of financial statements and the purposes statements can be used for
- read financial statements and to calculate and interpret key financial ratios
- understand the key role of accounting systems in providing information for decision-making within organizations and how this information can be used to manage both the organization and the behavior of individuals within the organization
- evaluate and assess the financial profitability of products, services, customers, and investments and make sound business decisions based on this information
- understand the role of corporate governance in organizations and society
- use basic functions of excel

Contents:

The concept of accounting and its meaning in firms and society
The content and differences of management and financial accounting.
The course covers the following themes in the area of financial accounting:
- The goals, contents and structure of statements; central accounting principles, basics of bookkeeping
- Balance sheet, Income statement, Cash flow statement and their connections
- International Financial Reporting Standards (IFRS), principles of group accounts
- Connections between Income statement and taxation
- Financial statement analysis

Management accounting:
- Accounting for strategic management; Implementing strategy, scorecards
- Management of a profit center organization (including Economic Value Added and WACC)
- Budgeting and Budgetary system
- Cost accounting tasks and cost concepts, product, service and customer profitability
- Ad hoc calculations, cost-volume-profit analysis and pricing
- Estimating the profitability of investments
- Key concepts of corporate governance

Mode of delivery:

Online education.

Learning activities and teaching methods:

Each theme contains an anchoring assignment that is intended to awaken the student’s interest in the topic. Anchoring assignments are individual assignments. After going through the actual contents of the theme, the student will perform some applied assignments. At the end of the course, there will be a few of more extensive assignments that are performed as group work.
Video materials, 6 h
Anchoring assignment, 64 h
Reading course book, 20 h
Complementary assignments, 33 h

Target group:

Degree students at University of Oulu (excluding degree students at Oulu Business School).

Prerequisites and co-requisites:

Secondary school mathematics.

Recommended or required reading:

Course book: Ikäheimo, Malmi & Walden, Yrityksen laskentatoimi, 2016.

Assessment methods and criteria:

Anchoring and applied assignments, 30 % (of the final grade)
Complementary assignments, 20 %
Exam, 50 %

Person responsible:

Teemu Malmi and Seppo Ikäheimo (Aalto University).

724831P: Introduction to Business Law, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS - 133 hours of student's work.

Language of instruction:

Finnish.

Timing:

April-May 2018.

Learning outcomes:

After the course, the student will:
- know the main features of the Finnish legal system and its connections to other legal systems, most important legal concepts and structures particularly from the business perspective
- know different sources of law and the fundamentals of how to solve legal problems
- understand the role of law as a system that steers the society and its importance in the core of business activities
- recognize the possibilities and limitations that law provides for business
- understand how and why a company should prepare for the legal risks related to business, how to manage the risks, and how to take the legal aspect into account in the firm’s decision making
- know the basic content of key areas of business law. In particular, they are: company law, contract law, immaterial law, labour law, competition law, and tax law.

Contents:

- Structure of the Finnish legal system and its relationship to other legal systems
- Basic legal concepts and structures
- Relevance of law in the core of societal decision-making and business activities
- Risks and possibilities that law provides for business
- Legal risk management in business
- Sources of law and their mutual relationship
- The fundamentals of solving legal problems
- Basics of company law
- Basics of contract law
- Basics of immaterial law
- Basics of labour law
- Basics of competition law
- Basics of tax law

Mode of delivery:

Online education.

Learning activities and teaching methods:

The purpose of the course exercises is to repeat the main issues and to deepen the student’s understanding by transferring theoretical knowledge into practice. Exercises deal with, for example, the basic concepts and structures of the legal system, recognizing legal problems, and the basics of different fields of business law, including case exercises.

Target group:

Degree students at University of Oulu (excluding degree students at Oulu Business School).

Recommended or required reading:

Literature will be assigned by the teacher at the beginning of the course.

Assessment methods and criteria:

Students are graded on a scale of 1-5 based on the course exam.

Grading:

1-5.

Person responsible:

Martti Nieminen (University of Tampere).

724832P: Economics and The Business Environment, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS - 133 hours of student's work.

Language of instruction:

Finnish.

Timing:

March-April 2018.

Learning outcomes:

On successful completion of the course, students will be able to:

- define basic economic concepts’
- understand economic thinking and to apply economic theory in the analysis of the business environment and market economies.

Contents:

The course provides students with basic skills in analyzing the business environment and its evolution from an economic perspective. Proactive identification of opportunities and threats of the business environment is increasingly important for successful businesses in the global economy. During the course, students will familiarize themselves with the decision-making of firms and consumers and how the markets function (microeconomics); economic growth, business cycles, labour markets, inflation, monetary policy, and economic policy (macroeconomics); the role of the public sector and focal public policy instruments in market economies (public economics); international trade, financial markets, European integration and multinational companies (global economy).

Mode of delivery:

Online education.

Learning activities and teaching methods:

Individual assignments according to the instructions given at the beginning of the course.

Target group:

Degree students at University of Oulu (excluding degree students at Oulu Business School).

Recommended or required reading:

The teachers will specify the literature at the beginning of the course.

Assessment methods and criteria:

Evaluation on scale 1-5.

Grading:

1-5.

Person responsible:

Jussi Heikkilä (University of Jyväskylä) and Matti Hovi (University of Tampere).

724833P: Introduction to Entrepreneurship, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS - 133 hours of student's work.

Language of instruction:

Finnish or English.

Timing:

January-February 2018.

Learning outcomes:

During the course, the student will form an understanding of entrepreneurship as a creative activity that happens in the form of business. After completing the course, the student will be able to:

- understand the principles, possibilities and challenges of business-planning and particularly the way of planning that initiates from customer needs, value-creation, testing and agility.
- recognize the business-related substance areas where competence is needed.

Contents:

The decision to become an entrepreneur

- Introduction to entrepreneurship

Creating viable business ideas

- Creating business opportunities
- Preliminary research
- Industry analysis
- Business plan

From an idea to an entrepreneurial firm

- Building a team
- Analyzing the start-up strengths and weaknesses from the funding perspective
- Ethical and legal issues in starting a firm
- Writing a business plan and constructing a story
- Attracting funding

Managing an entrepreneurial firm and creating growth

- Marketing
- Understanding VC-operations
- IPRs
- Challenges of growth and managing growth
- Growth strategies
- Operation forms

Mode of delivery:

Online education.

Learning activities and teaching methods:

Course assignments include:

- An introductory exam and familiarization with the course book.
- Online lectures and related assignments

- Workshops

The assignments are done both as individual and group work.

Familiarization with the goals, assignments and the conduct of the course	3 h
Online lectures	15 h
Reading the course book	30 h
Making the assignments	30 h
Preparing for the intermediate exams	40 h
Taking the intermediate exams	15 h

Target group:

Degree students at University of Oulu (excluding degree students at Oulu Business School).

Recommended or required reading:

The teachers will specify the literature at the beginning of the course.

Assessment methods and criteria:

Student performance will be evaluated on a scale from 1 to 5. The student will decide in which scope he/she wants to take the course. A student who passes the themes and exercises of the first intermediate exam will get a grade of 1 or 2. If the student also passes the themes and activities of the second intermediate exam, he/she will get a grade of 3 or 4. If the student also passes the themes and activities of the third intermediate exam, he/she will get a grade of 5. Grade 0 indicates a fail.

Grading:

1-5.

Person responsible:

Vesa Puhakka (University of Oulu), Markku Ikävalko and Elena Ruskovaara (Lappeenranta University of Technology).

724834P: Basics of Marketing and Sales, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Pauliina Ulkuniemi

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS - 133 hours of student's work.

Language of instruction:

Finnish or English.

Timing:

February- March 2018.

Learning outcomes:

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

- describe the role of marketing in an organization and in relation to other central business processes of an organization.
- describe the diverse emphasis of B-to-B and consumer marketing and the key characteristics of both logics.
- apply key concepts of marketing (e.g., customer-perceived value, value-creation process, brand) in their daily work.
- apply the central concepts of strategic planning and to create a general strategic plan.
- utilize influential phenomena of the business context (e.g., solution orientation, servitization, networking) in strategic planning.

- describe how to develop organizations to be more customer-oriented in their operations.
- describe the relevance of interaction skills in sales work. Students will be able to analyze and evaluate sales work.

In addition, students will be able to:

- identify key marketing communication channels in the fickle business environment, and based on this, they will be able to describe the status and possibilities of marketing communications.
- understand what “sustainable marketing” means.
- understand the sales process in its entirety. The students are able to identify the content of different parts of the sales process in practice both in consumer and in B-to-B sales.

Contents:

Key marketing concepts, definitions and phenomena now and before such as value, value creation, marketing mix.
Understanding these concepts in diverse contexts: the differences between consumer and B-to-B logics.
Customer-oriented strategy in a changing business environment.
The key concepts and phenomena in consumer marketing.
B-to-B marketing and organizational buying behavior.
Marketing communication channels and contents in the current business environment.
Sales process in consumer and B-to-B contexts.
Personal sales and interaction skills at different phases of the sales process.

Mode of delivery:

Online education.

Learning activities and teaching methods:

Students will complete weekly exercises that are then used as the basis for the graded final essay. Customer experience exercise will help analyze and evaluate the sales process and salesperson interaction from the customer’s perspective.

Target group:

Degree students at University of Oulu (excluding degree students at Oulu Business School).

Recommended or required reading:

- Kotler, P. & Armstrong, G. (2013 or newer edition), Principles of Marketing, Pearson, Harlow. Relevant parts are defined by the teachers.
- Jobber, D. & Lancaster, G. (2009 or newer edition), Selling and Sales Management (8th edition), Prentice Hall, Harlow. Relevant parts are defined by the teachers.
- Any other material appointed by the teachers

Assessment methods and criteria:

Students complete the course by writing a final essay, in which the students analyze a firm that they have chosen for weekly exercises by applying the theoretical content of the course. Grading is from 1 to 5. In addition, weekly exercises are evaluated as a pass/fail.

Grading:

Grading is from 1 to 5. In addition, weekly exercises are evaluated as a pass/fail.

Person responsible:

Hanna Komulainen (University of Oulu) and Minna-Maarit Jaskari (University of Vaasa).

Working life cooperation:

Upon completion of the course, students will be able to identify the meaning of customer orientation in developing organizations, in their personal activities and in their professional development. Students will be able to understand organizational operations as a whole and how decisions made are linked to customer behavior, and therefore, to financial results.

Other information:

The LITO courses are organised in co-operation with multiple universities. To enable registering credits when the course is completed, it is necessary to transfer data about the student from their home university to the university that is responsible for organizing the course. The data to be transferred consists of: name, gender, nationality, e-mail address, personal identification number and the home university. Data that is classified as secret is not transferred. Without data transfer it is not possible to have the course credits registered.

724835P: Basics of Management and Organizations, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS - 133 hours of student's work.

Language of instruction:

Finnish or English.

Timing:

October-November 2017.

Learning outcomes:

On successful completion of the course, the students will be able to:
- examine organizations and organizational behavior
- name the key concepts and theories in the areas of organization, management, and leadership
- describe the key functions and tools of strategic management
- name key concepts and evaluate the functions of human resource management
- understand the main concepts and ideas of organizations, human resource management, and strategic management
- develop leadership skills
- understand major tools of strategic management
- understand key concepts and functions of management and organization
- understand how business is affected by global networks
- apply theory on practical leadership and management situations

Contents:

Organizations and organizational behavior
- organizational structure
- organizational culture
- organizational life

Management and leadership
- the development of leadership thinking and leadership theory
- key concepts of management
- leading culture, innovation and change

Strategic thinking and strategic tools
- the development of strategic thinking and strategy models
- strategic tools
- strategic management in global environment
- ethics, corporate social responsibility

Human resource management
- human resource management
- leading individuals, teams and groups
- motivation and coaching
- learning organization

Mode of delivery:

Online education.

Learning activities and teaching methods:

Portfolio (including weekly assignments), peer evaluation and vocabulary assignment (key concepts).

Online lectures	10 h
Portfolio and peer feedback	50 h
Vocabulary assignment (key concepts)	10 h
Literature (approximately 268 pages)	64 h

Target group:

Degree students at University of Oulu (excluding degree students at Oulu Business School).

Recommended or required reading:

Stephen P. Robbins, Tim Judge: Essentials of Organizational Behavior, Global Edition, Dawsonera e-Book collection. The course instructors may ask students to read additional literature (e.g. articles). Details of additional readings are given at the beginning of the course.

Assessment methods and criteria:

Evaluation: numeric, scale 1-5.

Grading:

1-5.

Person responsible:

Susanna Kultalahti (University of Vaasa).

724836P: Introduction to Corporate Social Responsibility, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS - 133 hours of student's work.

Language of instruction:

English.

Timing:

November-December 2017.

Learning outcomes:

Students will develop a basic understanding of the key concepts and perspectives that form the basis for Corporate Responsibility in relation to different business disciplines.
After completing the course, the student will be able to:
- define and apply key concepts and perspectives regarding corporate responsibility (CSR)
- identify relevant issues and analyze the challenges related to corporate responsibility in selected industries.

Contents:

The course provides students an introduction to key concepts and perspectives that describe the challenges, opportunities, and risks that companies face regarding their social and environmental responsibilities. In the course, students have the opportunity to apply concepts and perspectives with different cases.

Mode of delivery:

Online education.

Learning activities and teaching methods:

The course has individual and group assignments.
The learning process and assignments:
The course is divided into four parts, which means that students need to individually complete one part per week. In order to complete the parts, you need to watch all the clips, complete the quizzes /exercises, write a short reflections (summary) based on your course readings, and review 2 short reflections written by other students. The review process is a very integral part of the course. Your review shows how much you have advanced in your studies, and it contributes to your general evaluation.
Cross case analysis (final essay)
You will write a final essay (a cross-case analysis) on two actual cases (will be provided). You will write the final essay in groups of 3-4.

Target group:

Degree students at University of Oulu (excluding degree students at Oulu Business School).

Recommended or required reading:

The link to primary reading materials will be provided on the learning platform.
Voluntary reading: Pedersen, E.R.G (ed.) (2015) Corporate Social Responsibility. London: Sage.

Assessment methods and criteria:

Four Short reflections: Peer graded (each 10%/total 40%).
Cross case analysis: Final assignment (60%).

Person responsible:

Nikodemus Solitander and Yewondwossen Tesfaye (Hanken School of Economics).

724837P: Understanding and managing a business as a dynamic whole - business simulation game, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS - 133 hours of student's work.

Language of instruction:

Finnish or English.

Timing:

Two optional times: March 2017 and May 2017.

Learning outcomes:

After completing the course, the student will:
- understand how different areas in business studies are connected in the entity of enterprise functions and in making a profit
- understand the role of ERP and its meaning in managing a company
- apply different business analysis tools in planning and managing a business and understand the essential role of strategy in the process

A central part of the course is to see the business as a whole: the student will understand why it's not practical to optimize single functions separately and why the management needs to have a holistic perspective of the company.

Contents:

- The foundation for this course is a business simulation game, which engages the students in real-time decision-making and provides them with various tasks related to various business topics.
- The participation takes place in small virtual groups, where the team members (3-4 students) may all come from different universities.
- The thematic core for the simulation is supply chain management and the entity formed by different functions of a company. The relevant themes include several areas of cross-company logistics: purchase, inventory management, delivery, customer relations, and the reporting related to these topics. The course emphasizes effective management of the supply chain and the impact it has on the company's profit and cash flow.
- During the course, the students are also introduced to the dynamics of supply chains in company networks, where the students' company is a part of a network of suppliers, competitors, and customers.
- In addition, the course gives an overall picture of the role of a company's information systems in steering the business as a whole: how the different functions utilize common enterprise resource-planning and how the ERP works as an essential tool in decision-making.

- The theoretic material and the exercises distributed in the course are related to the abovementioned supply chain management and other LITO learning themes.

Mode of delivery:

Online education.

Learning activities and teaching methods:

The assignments of the course are mainly related to the planning of the simulation company operations and to the analysis of materialized operations. These include:
- developing a business plan
- analyzing the profitability in light of various parameters and reporting these to the different stakeholders
- various strategic analyses on the company operations and on the competitive situation (SWOT, Pester, bench-marking)
- calculations related to the company's basic supply chain and ERP parameters
- income statement and profitability, gross margin, and cash flow analysis (the essential parameters covered in INTRODUCTION TO FINANCIAL ADMINISTRATION course)
- market analysis

Furthermore, a written assignment on team dynamics and a team functionality analysis and reflections.

Getting acquainted with the theoretical supplementary material	50h
Planning and analysis tasks	60h
Business simulation game	4 x 6h = 24h

Target group:

Degree students at University of Oulu (excluding degree students at Oulu Business School).

Prerequisites and co-requisites:

The course serves as a capstone, bridging together the other modules in the entity. The course provides an overall picture of the business dynamics and explains how the different fields in business studies are related to it.
In order to participate in the course, the student should have taken at least three other courses in the module (or have equivalent knowledge from previous studies).

Recommended or required reading:

Simulation game instructions, description on the simulation environment, self-learning videos, course hand-out, and selection of other articles (announced later).

Assessment methods and criteria:

A numeric evaluation scale of 1-5 will be in use. The performance will be rated based on the assignments given out during the course.

Grading:

1-5.

Person responsible:

Eeli Saarinen (University of Turku).

Other information:

The LITO courses are organised in co-operation with multiple universities. To enable registering credits when the course is completed, it is necessary to transfer data about the student from their home university to the university that is responsible for organizing the course. The data to be transferred consists of: name, gender, nationality, e-mail address, personal identification number and the home university. Data that is classified as secret is not transferred. Without data transfer it is not possible to have the course credits registered.

521285S: Affective Computing, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Guoying Zhao

Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr
Language of instruction:
English
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:
After completing the course, student
1. is able to explain the emotion theory and modeling

2. is able to implement algorithms for emotion recognition from visual and audio signals or the fusion of multi-modalities

3. has the ideas of wide applications of affective computing
Contents:
The history and evolution of affective computing; psychological study about emotion theory and modeling; emotion recognition from different modalities: facial expression, speech, EEG; crowdsourcing study; synthesis of emotional behaviors; emotion applications.
Mode of delivery:
Face to face teaching
Learning activities and teaching methods:
The course consists of lectures and exercises. The final grade is based on the points from exam while there are several mandatory exercises.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
A prior programming knowledge, possibly the bachelor level mathematical studies and/or some lower level intermediate studies (e.g. computer engineering or artificial intelligence courses). The recommended optional studies include the advanced level studies e.g. the pattern recognition and neural networks and/or computer vision courses.
Recommended optional programme components:
-
Recommended or required reading:
All necessary material will be provided by the instructor.
Assessment methods and criteria:
The assessment of the course is based on the exam (100%) with mandatory exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Guoying Zhao, Eero Väyrynen, Xiaohua Huang
Working life cooperation:
-
Other information:
-

080925A: Anatomy and Physiology for Biomedical Engineering, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Miika Nieminen, Kyösti Heimonen

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credit points / 135 hours of work

Language of instruction:
English
Timing:
Master studies, Spring 2018, 4th period
Learning outcomes:
The student is able to define human anatomy and describe the physiological functions, and can explain how these can be investigated using different imaging methods and measurement systems
Contents:
The course acquaites the student to human physiology and anatomy. Areas covered include
Cells and tissues,
Skin, blood, blood circulation and the fluids of the body
Musculoskeletal organs
Defence reactions of the body
Respiration
Digestion,
Urine sectretion
Metabolic regulation, heat regulation
Reproduction
Sensory functions
Nervous system
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 28h, demonstrations 12h. Independent studying and preparing reports 95h. Final examination
Target group:
Biomedical engineering and physics students
Recommended optional programme components:
The coure is an independent entity and does not require additional studies carried out at the same time. Imaging methods are more closely studied in the course Diagnostic Imaging.
Recommended or required reading:
Supplementary reading will be given in the beginning of the course.
Assessment methods and criteria:
Taking part in the lectures and demonstrations. Written reports on demonstrations. Final 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:
Professor Miika Nieminen
Working life cooperation:
Course demonstrations will be held in hospital environment and are related to diagnostics.
Other information:
max. 40 students

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 credit points / 135 hours of work
Language of instruction:
English

Timing:
2nd period for exchange students, Faculty of Medicine
3rd period for degree students and other exchange students i.e. BME
Learning outcomes:
The student can define central information and communication technological 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
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 patients
- 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
- future visions of health care information systems
- changing current topics in connected health like: AI, knowledge based medicine, cybersecurity, etc

Mode of delivery:
Web-based teaching
Learning activities and teaching methods:
Interactivity takes place in virtual learning environment Optima. The course consists of video-taped lectures, power point-presentations and links to other material available in the web. Performance of duties includes an essay, exam, participating in discussions on the grounds of the lectures.
Web lectures 15h / Web exam 40h / Written essay 40h* / Self-study and participation to web discussion 40h
(*Exchange student can relate their essay to the situation in their home countries)
Target group:
MSc and 3rd year BSc students of Biomedical Engineering and Medical Technology (medical technology, biomedical engineering, biophysics, physics, other degree programs), students of Health Sciences and information technology and everyone who is interested
Recommended or required reading:
All recommended or required reading are offered in Optima virtual learning environment
Assessment methods and criteria:
Web tasks, an essay and final 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 one stands for a fail.
Person responsible:
Professor Jarmo Reponen
Nina Keränen

521284S: Biomedical Engineering Project, 5 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits
Language of instruction:
English.
Timing:
As part of the master level studies, in any period suitable to the student.

Learning outcomes:
1. has develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation.
Contents:
A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work and the interests of student. Main emphasis is on the development and application of methods and algorithms for biomedical data processing. Often the work includes programming with Matlab, C or Java languages.
Mode of delivery:
Self-study under supervision.
Learning activities and teaching methods:
First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, and documentation. Task assignments can be applied at any time all year round.
Target group:
Master-level students that are interested in biomedical engineering. Students of the University of Oulu.
Prerequisites and co-requisites:
The mathematic studies of the candidate degree program of computer science and engineering, or equivalent. Courses such as Biosignal processing I and II, Biomedical image processing and Machine learning are recommended. Programming skills, especially 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:
Literature and scientific articles depending on the task assignment.
Assessment methods and criteria:
Course assessment is based on the technical report.
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
Other information:
-

521093S: Biomedical Instrumentation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Igor Meglinski

Opintokohteen kielet: Finnish

Leikkaavuudet:

521107S	Biomedical Instrumentation	6.0 op

ECTS Credits:
5
Language of instruction:
English.
Timing:
Period 3.
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 effects of electric current 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). Bioelectrical measurements (EKG, EEG, EMG, EOG, ERG), blood pressure and flow meters, respiration studies, measurements in a clinical laboratory, introduction to medical imaging methods and instruments, ear measurements, heart pacing and defibrillators, physical therapy devices, intensive care and operating room devices and electrical safety aspects.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Lectures/exercises 42 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:
R. S. Khandpur: Biomedical Instrumentation, Technology and Applications, McGraw-Hill, 2005 and J. G. Webster: Medical Instrumentation, Application and Design, 4th edition, John Wiley & Sons, 2010.
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:
Igor Meglinski
Working life cooperation:
No.

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 Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits / 50 hours of work
Language of instruction:
English. Examination can be taken in English or Finnish.
Timing:
The course unit is held in the autumn semester, during period 2. It is recommended to complete the course at the end of studies.
Learning outcomes:
After completing the course, student
1. knows special characteristics of the biosignals and typical signal processing methods
2. can solve small-scale problems related to biosignal analysis
3. implement small-scale software for signal processing algorithms
Contents:
Biomedical signals. Digital filtering. Analysis in time-domain and frequency domain. Nonstationarity. Event detection. Signal characterization.
Mode of delivery:
Face-to-face teaching and guided laboratory work.
Learning activities and teaching methods:
Lectures 10h, Laboratory work 20h, Self-study 20h, written examination.
Target group:
Students interested in biomedical engineering, at their master’s level studies.

Students of the University of Oulu.

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:
Laboratory work is supervised by assistants who also check that the task assignments are completed properly. All task assignments are compulsory. The course ends with a written exam.
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.
Other information:
-

521282S: Biosignal Processing II, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Kortelainen

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS cr
Language of instruction:
Lectures and laboratory works are given in English. The examination can be taken in Finnish or English.
Timing:
Period 4
Learning outcomes:
After completing the course, student
1. knows the special characteristics of neural signals and the typical signal processing methods related to them

2. can solve advanced problems related to the neural signal analysis
Contents:
Introduction to neural signals, artifact removal, anesthesia and natural sleep, topographic analysis and source localization, epilepsy, evoked potentials.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures (8 h) and laboratory work (20 h), written exam.
Target group:
Engineering students, medical and wellness technology students, and other students interested in biomedical engineering. Students of the University of Oulu.
Prerequisites and co-requisites:
The basic engineering math courses, digital filtering, programming skills, Biosignal Processing I.
Recommended optional programme components:
-
Recommended or required reading:

The course is based on selected parts from books "EEG Signal Processing", S. Sanei and J. A. Chambers, "Bioelectrical Signal Processing in Cardiac and Neurological Applications", L. Sörnmo and P. Laguna, and "Neural Engineering", B. He (ed.) as well as lecture slides and task assignment specific material.
Assessment methods and criteria:
Laboratory work is supervised by the assistants who will also check that the task assignments are completed properly. The course ends with a written exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading of the accepted exam is in the range 1-5.
Person responsible:
Jukka Kortelainen
Working life cooperation:
-
Other information:
-

521242A: Introduction to Biomedical Engineering, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Teemu Myllylä

Opintokohteen kielet: English

ECTS Credits:
5 ECTS cr
Language of instruction:
English
Timing:
Period 1
Learning outcomes:
After completing the course, the student has a basic knowledge of the biomedical engineering discipline and the applications of engineering science to biomedical problems.
Contents:
Biomedical engineering is a highly multidisciplinary field of study that ranges from theory to applications at the interface between such as engineering, biophotonics, medicine and biology. This course will introduce the subdisciplines within biomedical engineering, including systems physiology, bioinstrumentation, bioimaging and biomedical signal analysis. General issues of each of the subdisciplines will be illustrated together with selected examples and clinical applications. A number of lectures will be given by different lecturers working in health tech companies, University of Oulu and Oulu University Hospital, presenting the fields of the biomedical engineering. In addition, course offerings of biomedical engineering at the University of Oulu are introduced.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
The course includes lectures, demonstrations and a group project.
Target group:
-
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
University 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:
Teemu Myllylä
Working life cooperation:
Guest lecturers
Other information:
-

521289S: Machine Learning, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: 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 cr
Language of instruction:
English. Examination can be taken in English or Finnish.
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 the basics of gradient search method to design a linear discriminant function.

4. can apply regression techniques to practical machine learning problems.
Contents:
Introduction. Bayesian decision theory. Discriminant functions. Parametric and non-parametric classification. Feature extraction. Classifier design. Example classifiers. Statistical regression methods.
Mode of delivery:
Face-to-face teaching, guided laboratory work and independent assignment.
Learning activities and teaching methods:
Lectures 10h, Laboratory work 20h, Self-study 20h, Independent task assignment, written examination.
Target group:
Students who are interested in data analysis technology. Students of the University of Oulu.
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:
Duda RO, Hart PE, Stork DG, Pattern classification, John Wiley & Sons Inc., 2nd edition, 2001. Handouts.
Assessment methods and criteria:
Laboratory work is supervised by assistants who also check that the task assignments are completed properly. The independent task assignment is graded. The course ends with a written exam.
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 weighing the written exam by 2/3 and the task assignment by 1/3.

Person responsible:

Tapio Seppänen

Working life cooperation:

No

Other information:

-

521149S: Special Course in Information Technology, 5 - 8 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ojala, Timo Kullervo

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5-8

Language of instruction:

English or Finnish

Timing:

Autumn and Spring, periods 1-4.

Learning outcomes:

The learning outcomes are defined based on the course topic.

Contents:

Varies yearly.

Mode of delivery:

Face-to-face teaching, also web-based teaching can be used.

Learning activities and teaching methods:

Lectures, exercises, design exercise, project work and seminars depending on the topic of the year. The implementation of the course will be informed separately. The course can be given several times with different contents during the academic year and it can be included into the degree several times.

Target group:

M.Sc. level students of Computer Science and Engineering; other students are accepted if there is space in the classes.

Prerequisites and co-requisites:

Will be defined based on the contents.

Recommended optional programme components:

No.

Recommended or required reading:

Will be announced at the first lecture

Assessment methods and criteria:

Depends on the working methods.

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:

Professor of CSE

Working life cooperation:

-

900017Y: Survival Finnish Course, 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: 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 of Oulu University.
Required proficiency level:
No previous Finnish studies.
ECTS Credits:
2 ECTS credits
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:
Multi-modal teaching (Contact teaching, on-line teaching and independent work)
Learning activities and teaching methods:
Lessons 1–2 times a week (12–14 h) and guided self study (36 h)
Target group:
International degree and post-graduate degree students and exchange students 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 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi.

A452294: Biomedical Engineering: Signal and Image Processing (BME-SIP), advanced module, optional studies, 31 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

BME-SIP, optional studies, 30 ECTS cr

521156S: Towards Data Mining, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Tamminen, Heli Koskimäki

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish or English

Timing:

Autumn, period I.

Learning outcomes:

Student can recognize the type of the data before further analysis and the required preprocessing. The concrete learning outcomes are:

1. Student can design and implement the data gathering
2. Student can combine data from different sources
3. Student can normalize and transfor data, and handle missing or incorrect data.
4. Student can ensure the 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:

16h lectures, 16h 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:

Participation in mandatory classes and 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 and Koskimäki Heli

Working life cooperation:

-

Other information:

-

031025A: Introduction to Optimization, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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.

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:

-

521348S: Statistical Signal Processing, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

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 autumn semester of the master studies.

Learning outcomes:

Upon completion the student will

1. understand the key concepts in estimation theory such as the classical and Bayesian framework.
2. masters the most important estimation principles such as minimum variance, maximum likelihood, least squares and minimum mean square error estimators.
3. can derive an estimator for a given criterion and basic data models.
4. can use the methodology of estimation theory to analyze the performance of estimators
5. can choose a proper estimator for a given purpose
6. understands the basics of detection and classification theory: hypothesis testing, receiver operating characteristics (ROC), matched filtering, estimator-correlator

Contents:

Estimation theory, minimum variance unbiased estimator, Cramer-Rao lower bound, linear models, general minimum variance unbiased estimation, best linear unbiased estimators, maximum likelihood estimation, leas squares estimation, Bayesian estimation, linear Bayesian estimation, Kalman filters, statistical decision theory, receiver operating characteristics, hypothesis testing, matched filter, estimator-correlator.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-face-teaching (lectures and exercises) 50h, Matlab simulation exercises in groups 30 h, independent work 50 h.

Target group:

Electrical, communications, computer and system engineering as well as mathematics, physics and computer science students with knowledge of statistics in master or senior undergraduate level.

Prerequisites and co-requisites:

The required prerequisite is the completion of the following courses prior to enrolling for the course: 031080A Signal analysis, 031021P Statistics, 031078P Matrix algebra

Recommended optional programme components:

-

Recommended or required reading:

Parts from books Kay, Steven M. "Fundamentals of statistical signal processing, volume I: estimation theory." (1993), Kay, Steven M. "Fundamentals of statistical signal processing: Detection theory, vol. 2." (1998), Van Trees, Harry L. Detection, estimation, and modulation theory. John Wiley & Sons, 2004.

Assessment methods and criteria:

Continuous evaluation by solving homework problems, successful completion of simulation projects, a final exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero (0) stands for a fail.

Person responsible:

Markku Juntti

Working life cooperation:

-

Other information:

-

080927S: Connected Health and mHealth, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jarmo Reponen

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credit points / 135 hours of work

Language of instruction:

English

Timing:

1st period in even years

Learning outcomes:

The student can define central information and communication technological terms and solutions in healthcare related to connected health and mHealth.

Contents:

Will be specified in 2018

Mode of delivery:

Will be specified in 2018

Learning activities and teaching methods:

Will be specified in 2018

Target group:

MSc and 3rd year BSc students of Biomedical Engineering and Medical Technology (medical technology, biomedical engineering, biophysics, physics, other degree programs), students of Health Sciences and information technology and everyone who is interested

Assessment methods and criteria:

Will be specified in 2018
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 one stands for a fail.

Person responsible:

Professor Jarmo Reponen

521279S: Signal Processing Systems, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Olli Silven

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Autumn, period 2

Learning outcomes:

1. Student can explain the challenges of signal processing hardware, software, and design methodologies.

2. Student is able to transform a digital filter designed with floating point arithmetic into a fixed point precision implementation, optimizing the word lengths to achieve the performance specifications.

3. Student is able to explain the most important algorithm implementation structures and can identify their usage contexts.

4. Student has rudimentary practical skills in modeling, designing, and judging finite word length signal processing algorithms with Matlab and Simulink software tools.

Contents:

Binary and floating point arithmetic, DSP programming models and co-design, digital signal processors, algorithms and implementations, including CORDIC, transforms (FFT and DCT), multi-rate signal processing, polyphase filters, filter banks, adaptive algorithms and applications. The software environments of the course are Matlab with the Fixed Point Toolbox extension and Simulink with the DSP Blockset extension.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

The course consists of lectures (30 h) and design exercises (6-12 h). the rest as independent work (33h).

Target group:

Computer Science and Engineering students: This is an advanced-level course intended for masters-level students, especially to those that are specializing into signal processing. + Other Students of the University of Oulu.

Prerequisites and co-requisites:

521337A Digital Filters, 521267A Computer Engineering or 521286A Computer Systems, 8 ECTS cr or 521287A Introduction to Computer Systems, 5 ECTS cr

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 materials. Material is in English.

Assessment methods and criteria:

Final exam and approved design 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:

Olli Silven

Working life cooperation:

None.

Other information:

-

521240S: Biophotonics and Biomedical Optics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Igor Meglinski

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

English

Timing:

Period 2

Learning outcomes:

On successful completion of the course, students will be able to categorize the basic principles of modern optical and laser-based diagnostic modalities and instruments used in advanced biomedical research and clinical medicine. They will be able to demonstrate detailed understanding and evaluate the key biophotonics techniques underlying day-to-day clinical diagnostic and therapies and industrial applications in pharmacy, health care and cosmetic products. They can operate with the selected techniques of their choice.

Contents:

The course includes in-depth coverage of state-of-the-art optical imaging and spectroscopy systems for advanced biomedical research and clinical diagnosis, fundamental properties of light such as coherence, polarization, angular momentum, details of light interaction with tissue, and modern imaging system. Coherent Optical Tomography (OCT), Laser Doppler Flowmetry, Laser Speckle Imaging (LSI), Photo-Acoustic Tomography (PAT), Tissue polarimetry; Optical and Near-Infra-Red Spectroscopy (NIRS), Confocal and Fluorescence Microscopies; Tissue Optics: Light/matter interactions, index of refraction, reflection, optical clearing, absorption, Mie scattering, Rayleigh scattering, Monte Carlo modelling.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures/exercises 42 h and self-study 100 h.

Target group:

Students interested in biomedical measurements.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

A new course

Recommended or required reading:

V.V Tuchin: Handbook of Optical Biomedical Diagnostics, SPIE Press, 2002; V.V Tuchin: Handbook of Coherent Domain Optical Methods, Springer, 2nd edition, 2013. D.A Boas, C. Pitris, N. Ramanujam, Handbook of Biomedical Optics, CRC Press, 2011.

Assessment methods and criteria:

The course is passed by the final exam and with the assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1 - 5

Person responsible:

Igor Meglinski

Working life cooperation:

No.

521161S: Multi-Modal Data Fusion, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Abdenour Hadid

Opintokohteen kielet: English

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn Semester either in Period I or Period II (preferably in Period I).

Learning outcomes:

Upon completion the student should be able to understand the problem of combining data (such as images and audios) of different natures and coming from different sources. The student should be able to implement basic solutions towards the accomplishment of a given task requiring the integration and combination of data.

Contents:

This course will provide a comprehensive introduction to the concepts and ideas of multi-sensor data fusion. The course will be illustrated with many real-life examples taken from a diverse range of applications. The course will be self-contained as much as possible (no previous knowledge of multisensor data fusion is assumed). Basic knowledge on related topics like image processing and signal processing will be a plus.
The course will discuss the following topics:
Introduction
Sensors
Architecture
Common Representational Format

Spatial Alignment
Temporal Alignment
Semantic Alignment
Radiometric Normalization
Bayesian Inference
Parameter Estimation
Robust Statistics
Sequential Bayesian Inference
Bayesian Decision Theory
Ensemble Learning
Sensor Management

Mode of delivery:

The course will be based on a combination of lectures (face-to-face teaching), home exercises and a final project.

Learning activities and teaching methods:

Face-to-face teaching: 20 h, home exercises: 80 h, final project: 35h

Target group:

Computer Science and Engineering, Ubiquitous Computing (M.Sc level, study years 4-5).

Prerequisites and co-requisites:

The course will be self-contained as much as possible (no previous knowledge is assumed). Basic knowledge on related topics like image processing and signal processing will be a plus.

Recommended optional programme components:

-

Recommended or required reading:

The course will be based on the following text book: H.B. Mitchell. Data Fusion: Concepts and Ideas. Springer (2012)

Assessment methods and criteria:

To pass the course, the student should retrun the exercices, complete a final programming project and pass an exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course will utilize a numercial grading scale 1-5.

Person responsible:

Abdenour Hadid (lecturer), Zinelabidine Boulkenafet (Assistant)

Working life cooperation:

The course includes one or two guest lectures from experts with practical experience.

Other information:

-

900013Y: Beginners' Finnish Course 1, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900013Y	Beginners' Finnish Course 1 (OPEN UNI)	2.0 op

Proficiency level:

A1.2

Status:

The course is intended for the international students in every faculty of Oulu University.

Required proficiency level:

A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.

ECTS Credits:

3 ECTS credits

Language of instruction:

As much Finnish as possible; English will be used as a help language.

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.

Contents:

This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person, expressing opinions, describing people and things, talking about weather and seasons, the names of the months and colours.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, the genitive and partitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.

Mode of delivery:

Contact teaching and guided self study

Learning activities and teaching methods:

Lessons 2 times a week (26 h) and guided self study (50 h)

Target group:

International degree and post-graduate degree students and exchange students of the University

Prerequisites and co-requisites:

Completion of the Survival Finnish Course

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)

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 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi. The course will start right after the Survival Finnish course.

521124S: Sensors and Measuring Techniques, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Igor Meglinski, Teemu Myllylä
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

English.

Timing:

Period 1.

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.

Target group:

4 year students.

Prerequisites and co-requisites:

No.

Recommended optional programme components:

No.

Recommended or required reading:

H. N. Norton: Handbook of Transducers, Prentice Hall P T R, 1989 or 2002; lecture and exercise notes.

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:

Igor Meglinski, Teemu Myllylä

Working life cooperation:

No.

080920S: Diagnostic Imaging, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Miika Nieminen
Opintokohteen kielet: English

ECTS Credits:

5 ECTS credit points / 135 hours of work

Language of instruction:

English

Timing:

Master studies, Autumn 2017, 1st and 2nd periods

Learning outcomes:

The student is able to define the physical principles on which various medical imaging devices are based upon.

Contents:

The course acquaints the students to the basic physics related to imaging modalities and therapeutic systems used in hospitals. Covered topics include e.g. x-ray imaging, computed tomography, magnetic resonance imaging, nuclear medicine and methods of clinical neurophysiology.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 26h, demonstrations 8h, excercises 4h, independent studying and preparing reports 97h. Final exam.

Target group:

Biomedical Engineering MSc students (medical technology, information technology, and other related degree programs), Physics MSc students (biophysics/medical physics) and other minor subject students. Also for the other students of the University of Oulu.

Prerequisites and co-requisites:

Recommended: physics basic courses and Radiation physics, biology and safety (766116P, 761116P, 764117P or 764317A).

Recommended optional programme components:

BME-courses

Recommended or required reading:

Dowsett, Kenny, Johnston: The Physics of Diagnostic Imaging, 2nd ed., Hodder Arnold, 2006.

Assessment methods and criteria:

Taking part in the lectures and demos. Written report on demonstrations. Final 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:

Professor Miika Nieminen

Working life cooperation:

Demonstrations are held in hospital environment and are related to diagnostics.

900053Y: Beginners' Finnish Course 2, 5 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900053Y	Beginners' Finnish Course 2 (OPEN UNI)	4.0 op

Proficiency level:

A1.3

Status:

The course is intended for the international students in every faculty of Oulu University.

Required proficiency level:

A1.2, completion of the Beginners’ Finnish course 1 (900013Y) or the equivalent language skills.

ECTS Credits:

5 ECTS credits

Language of instruction:

As much Finnish as possible; English will be used as a help language.

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some very common everyday expressions and sentences. S/he can communicate in easy and routine tasks requiring a simple and direct exchange of information on familiar everyday matters. The student understands different kinds of short texts. S/he can for example locate important information in them. In addition, s/he has acquired more detailed knowledge of the language and culture.

Contents:

This is a post-elementary course. During the course students learn more about communication in ordinary everyday situations in Finnish. They also extend their vocabulary and knowledge of grammar. Students practise understanding simple Finnish talk and short texts.

The topics and communicative situations covered in the course are: asking for and giving directions, asking for help/favours, carrying out transactions in shops and restaurants, talking about the past, asking for and expressing opinions and feelings, accommodation, travelling, vehicles, work, professions, food, drink and parties.

The structures studied are: the local cases, nominative plural (basic form plural), imperfect (past tense of verbs), part of the imperative, more declension types for nouns (word types), more about the change of the consonants k, p and t in verbs and nouns, declension of the demonstrative pronouns and personal pronouns, more about the partitive case, basics of the object cases, postpositions and some sentence types in Finnish.

Mode of delivery:

Contact teaching and guided self study

Learning activities and teaching methods:

Lessons 2 times a week (50 h) and guided self study (75 h)

Target group:

International degree and post-graduate degree students and exchange students of the University

Prerequisites and co-requisites:

Completion of the Beginners' Finnish Course 1

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S.: **Suomen mestari 1** (kappaleet 6-9)

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written midterm and final exams will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi. The lessons will be held **twice a week** during a 13-week period.

521337A: Digital Filters, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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:

1. Sampling theorem, aliasing and imaging, 2. Discrete Fourier transform, 3. Z-transform and frequency response, 4. Correlation and convolution, 5. Digital filter design, 6. FIR filter design and realizations, 7. IIR filter design and realizations, 8. Finite word length effects and analysis, 9. Multi-rate signal processing.

Mode of delivery:

Face-to-face teaching (Lectures), independent work, group work

Learning activities and teaching methods:

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:

Lecture notes and exercise materials. Material is in Finnish and in English. Course book: Ifeachor, E., Jervis, B.: Digital Signal Processing, A Practical Approach, Second Edition, Prentice Hall, 2002.

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:

-

521466S: Machine Vision, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Spring, period 3.

Learning outcomes:

After completing the course, student
1. can utilize common machine vision methods for various image analysis problems

2. can detect and recognize objects using features computed from images

3. can use motion information in image analysis

4. can use model matching in image registration and object recognition

5. can explain the basics of geometric computer vision

6. can calibrate cameras

7. can use stereo imaging for 3D reconstruction

8. can use Matlab for implementing basic machine vision algorithms

Contents:

Course provides an introduction to machine vision, and its applications to practical image analysis problems. Common computer vision methods and algorithms as well as principles of image formation are studied. Topics: 1. Introduction, 2. Imaging and image representation, 3. Color and shading, 4. Image features, 5. Recognition, 6. Texture, 7. Motion from 2D image sequences, 8. Matching in 2D, 9. Perceiving 3D from 2D images, 10. 3D reconstruction.

Mode of delivery:

Face-to-face teaching, homework assignments.

Learning activities and teaching methods:

Lectures (20 h), exercises (16 h) and Matlab homework assignments (16 h).

Target group:

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

Prerequisites and co-requisites:

521467A Digital Image Processing

Recommended optional programme components:

521289S Machine Learning. This courses provide complementary information on machine learning methods applied in machine vision. It is recommended to be studied simultaneously.

Recommended or required reading:

Lecture notes and exercise material. The following books are recommended for further information: 1) Shapiro, L.G., Stockman,G.C.: Computer Vision, Prentice Hall, 2001. 2) R. Szeliski: Computer Vision: Algorithms and Applications, Springer, 2011. 3) D.A. Forsyth & J. Ponce: Computer Vision: A Modern Approach, Prentice Hall, 2002.

Assessment methods and criteria:

The course is passed with final exam and accepted homework assignments.
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:

Janne Heikkilä

Working life cooperation:

No.

Other information:

-

521495A: Artificial Intelligence, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Abdenour Hadid

Opintokohteen kielet: English

Leikkaavuudet:

ay521495A	Artificial Intellig (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Period 3.

Learning outcomes:

1. is able to identify the types of problems that can be solved using methods of artificial intelligence.
2. knows the basic concepts of intelligent agents, the common search methods used in artificial intelligence, logic based reasoning and applying planning techniques to problems of artificial intelligence.
3. can also apply simple methods to reasoning under uncertainty and machine learning from observation.
4. In addition the student will be able to implement the most common search methods.

Contents:

1) Introduction, 2) Rational (Intelligent) Agents and Uninformed Search, 3) Informed Search, 4) Programming Project 1 (Pacman 1), 5) Adversarial Search (Games), 6) Programming Project 2 (Pacman 2), 7) Uncertainty and Utilities, 8) Markov Decision Processes, 9) Reinforcement Learning, 10) Bayesian Networks, 11) Machine Learning (learning from Observation), 12) Advanced Applications, 13) Conclusions

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

24 hours of lectures and a programming exercise (approximately 25 hours) during period 3, the rest as independent work.

Target group:

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

Prerequisites and co-requisites:

Programming 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:

The course material is based on the Artificial Intelligence course of Berkely University and the book "Artificial Intelligence, A Modern Approach" by Russell & Norvig.
1) http://ai.berkely.edu
2) Russell S., Norvig P.: Artificial Intelligence, A Modern Approach, Second Edition, Prentice Hall, 2003.

Assessment methods and criteria:

The course is passed with a final exam and a passed programming exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 / fail.

Person responsible:

Abdenour Hadid
Zinelabidine Boulkenafet

Working life cooperation:

-

Other information:

-

521097S: Wireless Measurements, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Saarela

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 Finnish or in English if two or more foreign students participate.

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 15-20 minutes presentation to other students in the seminars.

Target group:

Master level students regardless of master's programme.

Prerequisites and co-requisites:

No prerequirements, 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:

Juha Saarela

Working life cooperation:

No.

080916S: Biomechanics of Human Movement, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credit points / 135 hours of work.

Language of instruction:

English

Timing:

Master studies, 3rd period

Learning outcomes:

The student can describe the main challenges of movement biomechanics and principles for motion analysis. The student knows 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:

Musculoskeletal biomechanics. Motion sensors and motion analysis. Biomechanical modeling ofmovement. Balance measurement. Fall biomechanics. Measurement of physical activity.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 14h / Assignment 54h / Self-study 67h. Final exam.

Target group:

Biomedical Engineering MSc students (medical technology, information technology, other related degree programs). Physics MSc students (biophysics, medical physics). Other interested MSc students.

Prerequisites and co-requisites:

It is recommended to have basic knowledge on anatomy and physiology, statistical analysis, sensors and measurement techniques and signal processing.

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 on the course 080915S.

Recommended or required reading:

Material given during lectures.

Assessment methods and criteria:

Accepted home exercises and assignments, written exam. The exam includes definition and explanation assignments and problems.
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:

Professor Timo Jämsä

Working life cooperation:

None

521288S: Multiprocessor Programming, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521280S	DSP Laboratory Work	5.0 op

ECTS Credits:

5 ECTS cr / 135 hours of work

Language of instruction:

English

Timing:

Spring semester, periods 3-4

Learning outcomes:

Upon completition of the course, the student:
1. has basic understanding of multiprocessor architectures and heterogeneous computing,
2. has basic understanding on how to design and implement algorithms for heterogeneous platforms,

3. understands the possible challenges and shortcomings related to the current heterogeneous systems,

4. is able to use the OpenCL framework for designing, implementing and optimizing signal processing algorithms for heterogeneous platforms

Contents:

Algorithm design, general purpose computing on graphics processing units, heterogeneous computing, OpenCL programming and optimization

Mode of delivery:

Opening lecture and independent exercise project, which is divided into smaller sub-entities. The exercise project is performed using both desktop and mobile platforms. After each sub-entity, a short seminar is held where the students discuss their results and possible ways to optimize the performance of their implementation.

Learning activities and teaching methods:

Opening lecture (2h), seminars (8h) and independent exercise project (125h).

Target group:

Computer Science and Engineering students and other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those interested in signal processing, processor architectures and embedded systems programming.

Prerequisites and co-requisites:

Matrix Algebra 031078P, Elementary programming 521141P, Computer Systems 521286A, Digital Filters 521337A

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:

Students complete the course exercises after the attending to the opening lecture in groups of two students. Assessment is based on the quality of the completed exercises and exercise reports. More detailed information on assessment will be announced at the beginning of the course.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Teemu Nyländen

Working life cooperation:

-

Other information:

-

521493S: Computer Graphics, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiaopeng Hong, Yingyue Xu, Guoying Zhao

Opintokohteen kielet: English

Leikkaavuudet:

521140S	Computer Graphics	5.0 op

ECTS Credits:

7 ECTS credits

Language of instruction:

In English.

Timing:

Spring, period 4.

Learning outcomes:

Upon completion of the course, the student:
1. is able to specify and design 2D graphics algorithms including: line and circle drawing, polygon filling and clipping
2. is able to specify and design 3D computer graphics algorithms including transformations, viewing, hidden surface removal, shading, texture mapping and hierarchical modeling
3. is able to explain the relationship between the 2D and 3D versions of such algorithms
4. possesses the necessary basic skills to use these basic algorithms available in OpenGL

Contents:

The history and evolution of computer graphics; 2D graphics including: line and circle drawing, polygon filling, clipping, and 3D computer graphics algorithms including viewing transformations, shading, texture mapping and hierarchical modeling; graphics API (OpenGL) for implementation.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures 30 h / Self-study and programming assignments 104h.

Target group:

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

Prerequisites and co-requisites:

Programming skills using C++; basic data structures; simple linear algebra. Additionally recommended prerequisite is the completion of the following course prior to enrolling for course unit: 521267A Computer Engineering or 521286A Computer Systems or 521287A Introduction to Computer Systems

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:

1) Textbook: Edward Angel, Dave Shreiner: Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, Addison-Wesley 2015
2) Textbook: Edward Angel: Interactive Computer Graphics, 5th Edition, Addison-Wesley 2008
3) Reference: Peter Shirley, Michael Ashikhmin, Michael Gleicher, et al. : Fundamentals of Computer Graphics, second edition, AK Peters, Ltd. 2005
4) Lecture notes (in English)
5) Materials in the internet (e.g. OpenGL redbook) OpenGL Programming Guide or 'The Red Book': http://unreal.srk.fer.hr/theredbook/ OpenGL Video Tutorial: target=_blank>http://www.videotutorialsrock.com /opengl_tutorial/what_is_opengl/text.php

Assessment methods and criteria:

The assessment of the course is based on the exam (50%) and returned course work (50%).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5, zero stands for fail.

Person responsible:

Guoying Zhao, Xiaopeng Hong, Yingyue Xu

Working life cooperation:

No

Other information:

-

521283S: Big Data Processing and Applications, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ekaterina Gilman

Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

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 fundatmenals, data storage, batch and stream data processing, data analysis, privacy and security, big data use cases.

Mode of delivery:

Face-to-face teaching, 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, the exercises do not require programming skills but they are an advantage.

Recommended optional programme components:

Finishing 521290S Distributed Systems, 521497S Pattern recognition and neural networks, and 521286A Computer Systems is beneficial.

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 exercises, seminar presentations and short reports on a selected topic (group work), and answering two quizzes during the course. To pass the course, it is enough to get 50% of available points for each part. No exam.

Grading:

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

Person responsible:

Ekaterina Gilman

Working life cooperation:

The course includes also invited lectures from industry.

Other information:

-

080926A: Introduction to Biomedical Imaging Methods, 1 - 3 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

1-3 ECTS credit points / 27-81 hours of work.

Language of instruction:

English

Timing:

Master studies, 3rd or 4th period.

Learning outcomes:

The student understands and can describe the basic principles and main applications of imaging methods used in biomedical research.

Contents:

Differences between in vivo, ex vivo and in vitro imaging. Light and electron microscopy. Optical projection and coherence tomography. Optical in vivo imaging. Magnetic resonance imaging. Fourier transform infrared imaging spectroscopy. Raman imaging spectroscopy. Micro-computed tomography. Ultrasound imaging. Basics of image analysis and interpretation

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Scope of the course and the methods of implementation vary. The course includes lectures 16h and demonstrations 8h. Independent study is determined by the extent of the course to 3-57 hours. The course includes a final exam.

Target group:

All students who are interested in methods of biomedical imaging. The course is suitable for both Master and Doctoral students.

Recommended or required reading:

Required literature is given in the lectures.

Assessment methods and criteria:

Participation in the lectures and demonstrations (compulsory). Written exam (3 ECTS). The course can be taken as 1, 2 or 3 ECTS.
1 ECTS # participation in all the lectures
2 ECTS # participation in all the lectures and demonstrations
3 ECTS # participation in the lectures and demonstrations + final exam
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The 1 and 2 ECTS courses utilize verbal grading: pass or fail. The 3 ECTS course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral researcher Lassi Rieppo

521149S: Special Course in Information Technology, 5 - 8 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ojala, Timo Kullervo

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5-8

Language of instruction:

English or Finnish

Timing:

Autumn and Spring, periods 1-4.

Learning outcomes:

The learning outcomes are defined based on the course topic.

Contents:

Varies yearly.

Mode of delivery:

Face-to-face teaching, also web-based teaching can be used.

Learning activities and teaching methods:

Lectures, exercises, design exercise, project work and seminars depending on the topic of the year. The implementation of the course will be informed separately. The course can be given several times with different contents during the academic year and it can be included into the degree several times.

Target group:

M.Sc. level students of Computer Science and Engineering; other students are accepted if there is space in the classes.

Prerequisites and co-requisites:

Will be defined based on the contents.

Recommended optional programme components:

No.

Recommended or required reading:

Will be announced at the first lecture

Assessment methods and criteria:

Depends on the working methods.
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:

Professor of CSE

Working life cooperation:

-

521013A: Advanced Practical Training, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Riku Hietaniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

521027S	Advanced practical training	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
3
Language of instruction:
Finnish/English
Timing:
Whole academic year. Periods 1-4.
Learning outcomes:
After the advanced practical training the student can describe one possible future job, or another kind of position in an already familiar working environment. The student can identify problems in the working environment and solve them. The student can apply theoretical knowledge acquired in the studies to practical tasks. The student can identify roles of a diploma-engineer in the work place.
Contents:
Training in the research laboratories, development laboratories and process laboratories, among others, of the industry and institutions in the field of study. The technical goal of practical training is to give a general insight of the field in which the trainee will work after having taken the degree and to support and to promote theoretical studying. Likewise, the training has to acquaint the trainee with the social points of the industrial production and with industrial safety and has to give a sufficient picture of the technical details of the performing of different work. Furthermore, the training gives a general idea of the technical and economic organizing, administration and management of a company and its production.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
Students find their training jobs themselves.
Target group:
Computer Science and Engineering MSc students.

Prerequisites and co-requisites:
None.
Recommended optional programme components:
-
Recommended or required reading:
None.
Assessment methods and criteria:
For the compulsory MSc stage practical training lasting at least two months a training report is required for which an acceptable grade must be obtained. A more exact compilation instruction of the training report is on the WWW pages of the degree programs.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.
Person responsible:
Riku Hietaniemi
Working life cooperation:
Yes.

522987S: Master's Thesis in Biomedical Engineering, 30 op

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
30
Language of instruction:
English
Timing:
Second year of MSc
Learning outcomes:
The student knows the background and methods for the research field of his/her thesis, and is able to perform relatively large research project as well as to handle reporting of the results.
Contents:
Research project in the field of biomedical engineering and writing of the thesis.

Mode of delivery:
Face-to-face (supervision meetings)and independent work.
Learning activities and teaching methods:
Thesis can be made at different research groups of the university or in industry or health care system. The student writes the thesis independently supported by the supervisor. The topic and contents should be discussed with the professor beforehand.
Target group:
Second year MSc students (International Master’s Degree Programme in Biomedical Engineering).
Prerequisites and co-requisites:
-
Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously
Recommended or required reading:
-
Assessment methods and criteria:
Writing the thesis. Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale: 1 – 5
Person responsible:
Professor Tapio Seppänen
Working life cooperation:
Yes
Other information:

Detailed instructions:
http://www.oulu.fi/cse/studying/masters-thesis

521009S: The Maturity Test for Master`s Degree, 0 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

A452221: Module of the Option, Information Technology, 34 - 35 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

All compulsory

031025A: Introduction to Optimization, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: 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.

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:

-

521348S: Statistical Signal Processing, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

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 autumn semester of the master studies.

Learning outcomes:

Upon completion the student will

1. understand the key concepts in estimation theory such as the classical and Bayesian framework.
2. masters the most important estimation principles such as minimum variance, maximum likelihood, least squares and minimum mean square error estimators.
3. can derive an estimator for a given criterion and basic data models.
4. can use the methodology of estimation theory to analyze the performance of estimators
5. can choose a proper estimator for a given purpose
6. understands the basics of detection and classification theory: hypothesis testing, receiver operating characteristics (ROC), matched filtering, estimator-correlator

Contents:

Estimation theory, minimum variance unbiased estimator, Cramer-Rao lower bound, linear models, general minimum variance unbiased estimation, best linear unbiased estimators, maximum likelihood estimation, leas squares estimation, Bayesian estimation, linear Bayesian estimation, Kalman filters, statistical decision theory, receiver operating characteristics, hypothesis testing, matched filter, estimator-correlator.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-face-teaching (lectures and exercises) 50h, Matlab simulation exercises in groups 30 h, independent work 50 h.

Target group:

Electrical, communications, computer and system engineering as well as mathematics, physics and computer science students with knowledge of statistics in master or senior undergraduate level.

Prerequisites and co-requisites:

The required prerequisite is the completion of the following courses prior to enrolling for the course: 031080A Signal analysis, 031021P Statistics, 031078P Matrix algebra

Recommended optional programme components:

-

Recommended or required reading:

Parts from books Kay, Steven M. "Fundamentals of statistical signal processing, volume I: estimation theory." (1993), Kay, Steven M. "Fundamentals of statistical signal processing: Detection theory, vol. 2." (1998), Van Trees, Harry L. Detection, estimation, and modulation theory. John Wiley & Sons, 2004.

Assessment methods and criteria:

Continuous evaluation by solving homework problems, successful completion of simulation projects, a final exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero (0) stands for a fail.

Person responsible:

Markku Juntti

Working life cooperation:

-

Other information:

-

813621S: Research Methods, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

Leikkaavuudet:

521146S	Research Methods in Computer Science	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 periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

Learning outcomes:

Having completed the course, the student is able to explain the general principles of scientific research and the practices of scientific methodology. The student is also able to generate research problems in information processing sciences. The student is able to identify and describe the main research approaches and methods in information processing sciences, and choose the appropriate approach and method for a research problem. The student is also able to evaluate the methodological quality of a research publication. After the course the student is able to choose and apply the proper approach and method for his or her Master's thesis and find more information on the method from scientific literature.

Contents:

Introduction to general scientific principles, scientific research practices and quality of scientific publications, qualitative research approaches and selected research methods, quantitative research approaches and selected research methods, design science research and selected methods, requirements and examples of Master's theses, evaluation of research.

Mode of delivery:

Face-to-face teaching, lecture videos

Learning activities and teaching methods:

Lectures 40 h, exercises 30 h and individual work 65 h. Learning diary is written about the lectures and exercises. Exercises include group work.

Target group:

MSc students

Prerequisites and co-requisites:

Completion of Bachelor's studies

Recommended or required reading:

Lecture slides and specified literature

Assessment methods and criteria:

Accepted learning diary

Grading:

Pass or fail

Person responsible:

Arto Lanamäki

521279S: Signal Processing Systems, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Olli Silven

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Autumn, period 2

Learning outcomes:

1. Student can explain the challenges of signal processing hardware, software, and design methodologies.

2. Student is able to transform a digital filter designed with floating point arithmetic into a fixed point precision implementation, optimizing the word lengths to achieve the performance specifications.

3. Student is able to explain the most important algorithm implementation structures and can identify their usage contexts.

4. Student has rudimentary practical skills in modeling, designing, and judging finite word length signal processing algorithms with Matlab and Simulink software tools.

Contents:

Binary and floating point arithmetic, DSP programming models and co-design, digital signal processors, algorithms and implementations, including CORDIC, transforms (FFT and DCT), multi-rate signal processing, polyphase filters, filter banks, adaptive algorithms and applications. The software environments of the course are Matlab with the Fixed Point Toolbox extension and Simulink with the DSP Blockset extension.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

The course consists of lectures (30 h) and design exercises (6-12 h). the rest as independent work (33h).

Target group:

Computer Science and Engineering students: This is an advanced-level course intended for masters-level students, especially to those that are specializing into signal processing. + Other Students of the University of Oulu.

Prerequisites and co-requisites:

521337A Digital Filters, 521267A Computer Engineering or 521286A Computer Systems, 8 ECTS cr or 521287A Introduction to Computer Systems, 5 ECTS cr

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 materials. Material is in English.

Assessment methods and criteria:

Final exam and approved design 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:

Olli Silven

Working life cooperation:

None.

Other information:

-

521466S: Machine Vision, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Spring, period 3.

Learning outcomes:

After completing the course, student
1. can utilize common machine vision methods for various image analysis problems

2. can detect and recognize objects using features computed from images

3. can use motion information in image analysis

4. can use model matching in image registration and object recognition

5. can explain the basics of geometric computer vision

6. can calibrate cameras

7. can use stereo imaging for 3D reconstruction

8. can use Matlab for implementing basic machine vision algorithms

Contents:

Course provides an introduction to machine vision, and its applications to practical image analysis problems. Common computer vision methods and algorithms as well as principles of image formation are studied. Topics: 1. Introduction, 2. Imaging and image representation, 3. Color and shading, 4. Image features, 5. Recognition, 6. Texture, 7. Motion from 2D image sequences, 8. Matching in 2D, 9. Perceiving 3D from 2D images, 10. 3D reconstruction.

Mode of delivery:

Face-to-face teaching, homework assignments.

Learning activities and teaching methods:

Lectures (20 h), exercises (16 h) and Matlab homework assignments (16 h).

Target group:

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

Prerequisites and co-requisites:

521467A Digital Image Processing

Recommended optional programme components:

521289S Machine Learning. This courses provide complementary information on machine learning methods applied in machine vision. It is recommended to be studied simultaneously.

Recommended or required reading:

Lecture notes and exercise material. The following books are recommended for further information: 1) Shapiro, L.G., Stockman,G.C.: Computer Vision, Prentice Hall, 2001. 2) R. Szeliski: Computer Vision: Algorithms and Applications, Springer, 2011. 3) D.A. Forsyth & J. Ponce: Computer Vision: A Modern Approach, Prentice Hall, 2002.

Assessment methods and criteria:

The course is passed with final exam and accepted homework assignments.
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:

Janne Heikkilä

Working life cooperation:

No.

Other information:

-

521289S: Machine Learning, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: 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 cr

Language of instruction:

English. Examination can be taken in English or Finnish.

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 the basics of gradient search method to design a linear discriminant function.

4. can apply regression techniques to practical machine learning problems.

Contents:

Introduction. Bayesian decision theory. Discriminant functions. Parametric and non-parametric classification. Feature extraction. Classifier design. Example classifiers. Statistical regression methods.

Mode of delivery:

Face-to-face teaching, guided laboratory work and independent assignment.

Learning activities and teaching methods:

Lectures 10h, Laboratory work 20h, Self-study 20h, Independent task assignment, written examination.

Target group:

Students who are interested in data analysis technology. Students of the University of Oulu.

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:

Duda RO, Hart PE, Stork DG, Pattern classification, John Wiley & Sons Inc., 2nd edition, 2001. Handouts.

Assessment methods and criteria:

Laboratory work is supervised by assistants who also check that the task assignments are completed properly. The independent task assignment is graded. The course ends with a written exam.
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 weighing the written exam by 2/3 and the task assignment by 1/3.

Person responsible:

Tapio Seppänen

Working life cooperation:

No

Other information:

-

521288S: Multiprocessor Programming, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521280S	DSP Laboratory Work	5.0 op

ECTS Credits:

5 ECTS cr / 135 hours of work

Language of instruction:

English

Timing:

Spring semester, periods 3-4

Learning outcomes:

Upon completition of the course, the student:
1. has basic understanding of multiprocessor architectures and heterogeneous computing,
2. has basic understanding on how to design and implement algorithms for heterogeneous platforms,

3. understands the possible challenges and shortcomings related to the current heterogeneous systems,

4. is able to use the OpenCL framework for designing, implementing and optimizing signal processing algorithms for heterogeneous platforms

Contents:

Algorithm design, general purpose computing on graphics processing units, heterogeneous computing, OpenCL programming and optimization

Mode of delivery:

Opening lecture and independent exercise project, which is divided into smaller sub-entities. The exercise project is performed using both desktop and mobile platforms. After each sub-entity, a short seminar is held where the students discuss their results and possible ways to optimize the performance of their implementation.

Learning activities and teaching methods:

Opening lecture (2h), seminars (8h) and independent exercise project (125h).

Target group:

Computer Science and Engineering students and other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those interested in signal processing, processor architectures and embedded systems programming.

Prerequisites and co-requisites:

Matrix Algebra 031078P, Elementary programming 521141P, Computer Systems 521286A, Digital Filters 521337A

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:

Students complete the course exercises after the attending to the opening lecture in groups of two students. Assessment is based on the quality of the completed exercises and exercise reports. More detailed information on assessment will be announced at the beginning of the course.
Read more about [assessment criteria] at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Teemu Nyländen

Working life cooperation:

-

Other information:

-

521260S: Programmable Web Project, 5 op

Voimassaolo: 01.08.2006 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ivan Sanchez Milara

Opintokohteen kielet: English

Leikkaavuudet:

ay521260S	Programmable Web Project (OPEN UNI)	5.0 op

Status:

The course is mandatory for International Master's Programme in Computer Science and Engineering and Master's Programme in Computer Science and Engineering. It is optional for other degree and master programmes.

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Spring, periods 3-4.

Learning outcomes:

1. Understands the main design concepts related to REST architectural style and ROA architecture

2. Is able to design, test and implement different components of a RESTful Web API

3. Understands what hypermedia is and how can it be used to build RESTful Web APIs

4. Is able to implement simple clients using Web technologies

5. Becomes familiar with basic technologies to store persitent data on the server and serialize data in the Web

Contents:

RESTful Web APIs, hypermedia, transactional/non-transactional databases , RESTful clients (HTML5 and Javascript).

Mode of delivery:

Web-based teaching and face-to-face teaching.

Learning activities and teaching methods:

Lectures 4 h, guided laboratory work 15 h, the rest as self-study and group work. Each group implements programs and writes a report.

Target group:

M.Sc. level students of Computer Science and Engineering; other students of the university of Oulu are accepted if there is enough space in the classes.

Prerequisites and co-requisites:

Elementary programming. Applied Computing Project I is 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:

Mainly course slides and links to different Web resources announced during the first lecture. Course books: * Leonard Richardson, Mike Amundsen & Sam Ruby. RESTful Web APIs. O'Reilly Media 2013. ISBN: 978-1-4493-5806-8. * Leonard Richardson & Sam Ruby,RESTful Web Services. O'Reilly Media 2007. ISBN: 978-0-596-52926-0.

Assessment methods and criteria:

This course unit utilizes continuous assessment. The project work is divided in different deadlines that students must meet to pass the course. Each deadline will be assessed after completion.
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:

Ivan Sanchez Milara

Working life cooperation:

None.

Other information:

This course replaces the course “521260S Representing structured information”.

521161S: Multi-Modal Data Fusion, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Abdenour Hadid

Opintokohteen kielet: English

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn Semester either in Period I or Period II (preferably in Period I).

Learning outcomes:

Upon completion the student should be able to understand the problem of combining data (such as images and audios) of different natures and coming from different sources. The student should be able to implement basic solutions towards the accomplishment of a given task requiring the integration and combination of data.

Contents:

This course will provide a comprehensive introduction to the concepts and ideas of multi-sensor data fusion. The course will be illustrated with many real-life examples taken from a diverse range of applications. The course will be self-contained as much as possible (no previous knowledge of multisensor data fusion is assumed). Basic knowledge on related topics like image processing and signal processing will be a plus.
The course will discuss the following topics:
Introduction
Sensors
Architecture
Common Representational Format
Spatial Alignment
Temporal Alignment
Semantic Alignment
Radiometric Normalization
Bayesian Inference
Parameter Estimation
Robust Statistics
Sequential Bayesian Inference
Bayesian Decision Theory
Ensemble Learning
Sensor Management

Mode of delivery:

The course will be based on a combination of lectures (face-to-face teaching), home exercises and a final project.

Learning activities and teaching methods:

Face-to-face teaching: 20 h, home exercises: 80 h, final project: 35h

Target group:

Computer Science and Engineering, Ubiquitous Computing (M.Sc level, study years 4-5).

Prerequisites and co-requisites:

The course will be self-contained as much as possible (no previous knowledge is assumed). Basic knowledge on related topics like image processing and signal processing will be a plus.

Recommended optional programme components:

-

Recommended or required reading:

The course will be based on the following text book: H.B. Mitchell. Data Fusion: Concepts and Ideas. Springer (2012)

Assessment methods and criteria:

To pass the course, the student should retrun the exercices, complete a final programming project and pass an exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course will utilize a numercial grading scale 1-5.

Person responsible:

Abdenour Hadid (lecturer), Zinelabidine Boulkenafet (Assistant)

Working life cooperation:

The course includes one or two guest lectures from experts with practical experience.

Other information:

-

A452224: Module of the Option, Applied computing, 35 - 62 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521148S: Ubiquitous Computing Fundamentals, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannu Kukka
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Autumn, periods 1-2.

Learning outcomes:

1. has gained a good overview of the history and current state of ubiquitous computing

2. has learned to design, implement, and evaluate a ubiquitous computing system

3. has learned how to carry out a research project, from initial research problem formulation to concept development, and further to in-the-wild evaluation and reporting using an academic format

Contents:

Ubiquitous computing systems, privacy, field studies, ethnography, interfaces, location, context-aware computing, processing sequential sensor data.

Mode of delivery:

Lectures, group project

Learning activities and teaching methods:

Lectures 20 h, exercises 22 h, project work 50 h, self-study 43 h. Exercises and project work are completed as group work.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu.

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:

Required literature: John Krumm (editor) Ubiquitous Computing Fundamentals, Chapman & Hall, 2010, ISBN 978-1-4200-9360-5, 328 pages; selected scientific publications.

Assessment methods and criteria:

The course is graded based on the following criteria: - Attendance - Summaries of selected scientific publications - Interim reports during project work - Final project report.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Adjunct Professor Hannu Kukka

Working life cooperation:

The course teaches students how to design, implement, and evaluate an academic research project. Especially helpful to those students planning post-graduate studies.

Other information:

-

813621S: Research Methods, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

Leikkaavuudet:

521146S	Research Methods in Computer Science	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 periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

Learning outcomes:

Having completed the course, the student is able to explain the general principles of scientific research and the practices of scientific methodology. The student is also able to generate research problems in information processing sciences. The student is able to identify and describe the main research approaches and methods in information processing sciences, and choose the appropriate approach and method for a research problem. The student is also able to evaluate the methodological quality of a research publication. After the course the student is able to choose and apply the proper approach and method for his or her Master’s thesis and find more information on the method from scientific literature.

Contents:

Introduction to general scientific principles, scientific research practices and quality of scientific publications, qualitative research approaches and selected research methods, quantitative research approaches and selected research methods, design science research and selected methods, requirements and examples of Master’s theses, evaluation of research.

Mode of delivery:

Face-to-face teaching, lecture videos

Learning activities and teaching methods:

Lectures 40 h, exercises 30 h and individual work 65 h. Learning diary is written about the lectures and exercises. Exercises include group work.

Target group:

MSc students

Prerequisites and co-requisites:

Completion of Bachelor’s studies

Recommended or required reading:

Lecture slides and specified literature

Assessment methods and criteria:

Accepted learning diary

Grading:

Pass or fail

Person responsible:

Arto Lanamäki

521479S: Software Project, 7 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Christian Wieser
Opintokohteen kielet: English

ECTS Credits:

7

Language of instruction:

Finnish/English, material available in English.

Timing:

Autumn, periods 1-2.

Learning outcomes:

After completing the course, students have demonstrated their capabilities to design, develop and test real-life software. Further, they have shown their proficiency in professionally documenting their work during the assignment.

Contents:

Phases of software engineering process: requirement gathering, analysis, design, implementation, testing, (maintenance). Project-work, starting a project, project management, working with external parties, project documentation. Project related implementation techniques and tools, software documentation.

Mode of delivery:

Face-to-face and independent studies.

Learning activities and teaching methods:

Working methods: The course is done in groups of 3-4 students. The clients are typically various companies and societies. Project progress is supervised in formal reviews, where the project teams present their work as it reaches the milestones: the software requirement specification, the project plan, the software design specification, an operational prototype demonstration, the test documentation, and finally the functional software demonstration and release. In addition to formal reviews the project work is coordinated with steering group meetings. The work environment and development tools vary between projects. The number of students that can attend the course is limited. Lectures 10 h, design project in period 4-6 180 h.

Target group:

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

Prerequisites and co-requisites:

521457A Software Engineering, 521453A Operating Systems, 521141P Elementary Programming, 521286A Computer Systems or 521142A Embedded Systems Programming and varying project related background reading.

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:

Pressman, R.S.: Software Engineering A Practitioner's Approach, 4th edition, Mc Graw-Hill, 1997; Phillips, D.: The Software Project Manager's Handbook, IEEE Computer Society, 2000; Project documentation; project related manuals and handbooks.

Assessment methods and criteria:

Project work and documentation.
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:

Christian Wieser

Working life cooperation:

-

Other information:

-

521158S: Natural Language Processing and Text Mining, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: 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 1. It is recommended to complete the course at the end of period 1

Learning outcomes:

Upon completing the course, the student is expected to i) comprehend, design and implement basic (online) text retrieval and query systems; ii) account for linguistic aspects and perform word sense disambiguation; iii) perform basic (statistical) inferences using corpus; iv) manipulate (statistical) language modelling toolkits, online lexical databases and various natural language processing tools.

Contents:

Foundation of text retrieval systems, Lexical ontologies, word sense disambiguation, Text categorization, Corpus-based inferences and Natural Language Processing tools

Mode of delivery:

Face- to-face teaching and laboratory sessions

Learning activities and teaching methods:

Lectures (24 h), tutorial/laboratory sessions (10h), 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 to advanced) programming skills in Python

Prerequisites and co-requisites:

Programming skills (preferably) in Python

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:

Introduction to Information Retrieval, by C. Manning, P. Raghavan, and H. Schütze. Cambridge University Press, 2008. (Free from http://nlp.stanford.edu/IR-book/) Foundations of statistical natural language processing, by Manning, Christopher D., Schütze, Hinrich. Cambridge, Mass.: MIT Press, 2000

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:

-

811395A: Basics of Databases, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

Finnish. If at least four non-Finnish students take the course, an English exercise group will be organised.

Timing:

The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester.

Learning outcomes:

In addition, they have knowledge of modern non-relational database solutions (such as data warehouses and NoSQL-databases) and they have
commanding knowledge of making use of those non-relational databases (such as data mining and Big data techniques).

Contents:

Conceptual modelling (ER- and EER-diagrams), relational model (theory, databases, query techniques and normalization), transactions.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 45 h (in Finnish), compulsory exercises 24 h, reading 20 h, exams 21 h and self-studying 23 h

Target group:

Bachelor students

Prerequisites and co-requisites:

The student knows basics of programming.

Recommended or required reading:

Silberschatz, Korth & Sudarshan: Database system concepts. Elmasri & Navathe: Fundamentals of database systems.

Assessment methods and criteria:

The course is divided to five parts. All parts must be passed in a year. Students must show they achieve at least half of required knowledge of each part.

Grading:

fail, 1-5

Person responsible:

Juha Iisakka

521290S: Distributed Systems, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiang Su

Opintokohteen kielet: Finnish

Leikkaavuudet:

521266S-01	Distributed Systems, Exam	0.0 op
521266S-02	Distributed Systems, Exercise Work	0.0 op
521266S	Distributed Systems	6.0 op

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Spring, period 3.

Learning outcomes:

After completing the course, the student
1. is able to explain the key principles of distributed systems
2. apply the principles in evaluating major design paradigms used in implementing distributed systems
3. solve distributed systems related problems
4. design and implement a small distributed system

Contents:

Introduction, architectures, processes, communication, naming, synchronization, consistency and replication, fault tolerance, security, case studies.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

Lectures 22 h, exercises 16 h, project work 50 h, self-study 47 h.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu

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:

Required literature: Maarten van Steen and Andrew S. Tanenbaum, Distributed Systems – Principles and Paradigms, Third Edition, 2017.

Assessment methods and criteria:

The course uses continuous assessment so that there are 2 intermediate exams. Alternatively, the course can also be passed with a final exam. The course includes a mandatory project work.

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

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Professor Timo Ojala

Working life cooperation:

None.

Other information:

-

521147S: Mobile and Social Computing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Denzil Teixeira Ferreira

Opintokohteen kielet: Finnish

Leikkaavuudet:

521046A	Mobile Computing	5.0 op
521045S	Mobile Computing	5.0 op

Proficiency level:

English B2 - C2

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Spring, periods 3-4

Learning outcomes:

1. Ability to implement mobile user interfaces

2. Ability to implement online social network applications

3. Ability to explain the fundamental concepts of context awareness

4. Ability to explain the fundamental concepts of online communities

Contents:

Mobile interface design and implementation, mobile sensor acquisition, context awareness, social platforms, crowdsourcing, online communities, graph theory.

Mode of delivery:

Face to face teaching + independent work.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

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

Prerequisites and co-requisites:

Object oriented 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:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete individual assignments throughout the semester and a final pair-based project: build a mobile application, conduct or analysis of data. Passing criteria: the assignments and the project must be must be completed, receiving more than 50% of the available points.
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:

Denzil Ferreira

Working life cooperation:

None.

Other information:

-

521260S: Programmable Web Project, 5 op

Voimassaolo: 01.08.2006 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ivan Sanchez Milara

Opintokohteen kielet: English

Leikkaavuudet:

ay521260S	Programmable Web Project (OPEN UNI)	5.0 op

Status:

The course is mandatory for International Master's Programme in Computer Science and Engineering and Master's Programme in Computer Science and Engineering. It is optional for other degree and master programmes.

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Spring, periods 3-4.

Learning outcomes:

1. Understands the main design concepts related to REST architectural style and ROA architecture

2. Is able to design, test and implement different components of a RESTful Web API

3. Understands what hypermedia is and how can it be used to build RESTful Web APIs

4. Is able to implement simple clients using Web technologies

5. Becomes familiar with basic technologies to store persitent data on the server and serialize data in the Web

Contents:

RESTful Web APIs, hypermedia, transactional/non-transactional databases , RESTful clients (HTML5 and Javascript).

Mode of delivery:

Web-based teaching and face-to-face teaching.

Learning activities and teaching methods:

Lectures 4 h, guided laboratory work 15 h, the rest as self-study and group work. Each group implements programs and writes a report.

Target group:

M.Sc. level students of Computer Science and Engineering; other students of the university of Oulu are accepted if there is enough space in the classes.

Prerequisites and co-requisites:

Elementary programming. Applied Computing Project I is 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:

Mainly course slides and links to different Web resources announced during the first lecture. Course books: * Leonard Richardson, Mike Amundsen & Sam Ruby. RESTful Web APIs. O'Reilly Media 2013. ISBN: 978-1-4493-5806-8. * Leonard Richardson & Sam Ruby,RESTful Web Services. O'Reilly Media 2007. ISBN: 978-0-596-52926-0.

Assessment methods and criteria:

This course unit utilizes continuous assessment. The project work is divided in different deadlines that students must meet to pass the course. Each deadline will be assessed after completion.
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:

Ivan Sanchez Milara

Working life cooperation:

None.

Other information:

This course replaces the course “521260S Representing structured information”.

A452223: Module of the Option, Embedded Systems, 30,5 - 32 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

All compulsory

521479S: Software Project, 7 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Christian Wieser
Opintokohteen kielet: English

ECTS Credits:

7

Language of instruction:

Finnish/English, material available in English.

Timing:

Autumn, periods 1-2.

Learning outcomes:

After completing the course, students have demonstrated their capabilities to design, develop and test real-life software. Further, they have shown their proficiency in professionally documenting their work during the assignment.

Contents:

Phases of software engineering process: requirement gathering, analysis, design, implementation, testing, (maintenance). Project-work, starting a project, project management, working with external parties, project documentation. Project related implementation techniques and tools, software documentation.

Mode of delivery:

Face-to-face and independent studies.

Learning activities and teaching methods:

Working methods: The course is done in groups of 3-4 students. The clients are typically various companies and societies. Project progress is supervised in formal reviews, where the project teams present their work as it reaches the milestones: the software requirement specification, the project plan, the software design specification, an operational prototype demonstration, the test documentation, and finally the functional software demonstration and release. In addition to formal reviews the project work is coordinated with steering group meetings. The work environment and development tools vary between projects. The number of students that can attend the course is limited. Lectures 10 h, design project in period 4-6 180 h.

Target group:

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

Prerequisites and co-requisites:

521457A Software Engineering, 521453A Operating Systems, 521141P Elementary Programming, 521286A Computer Systems or 521142A Embedded Systems Programming and varying project related background reading.

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:

Pressman, R.S.: Software Engineering A Practitioner's Approach, 4th edition, Mc Graw-Hill, 1997; Phillips, D.: The Software Project Manager's Handbook, IEEE Computer Society, 2000; Project documentation; project related manuals and handbooks.

Assessment methods and criteria:

Project work and documentation.
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:

Christian Wieser

Working life cooperation:

-

Other information:

-

521279S: Signal Processing Systems, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Olli Silven
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS cr

Language of instruction:

English

Timing:

Autumn, period 2

Learning outcomes:

1. Student can explain the challenges of signal processing hardware, software, and design methodologies.

2. Student is able to transform a digital filter designed with floating point arithmetic into a fixed point precision implementation, optimizing the word lengths to achieve the performance specifications.

3. Student is able to explain the most important algorithm implementation structures and can identify their usage contexts.

4. Student has rudimentary practical skills in modeling, designing, and judging finite word length signal processing algorithms with Matlab and Simulink software tools.

Contents:

Binary and floating point arithmetic, DSP programming models and co-design, digital signal processors, algorithms and implementations, including CORDIC, transforms (FFT and DCT), multi-rate signal processing, polyphase filters, filter banks, adaptive algorithms and applications. The software environments of the course are Matlab with the Fixed Point Toolbox extension and Simulink with the DSP Blockset extension.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

The course consists of lectures (30 h) and design exercises (6-12 h). the rest as independent work (33h).

Target group:

Computer Science and Engineering students: This is an advanced-level course intended for masters-level students, especially to those that are specializing into signal processing. + Other Students of the University of Oulu.

Prerequisites and co-requisites:

521337A Digital Filters, 521267A Computer Engineering or 521286A Computer Systems, 8 ECTS cr or 521287A Introduction to Computer Systems, 5 ECTS cr

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 materials. Material is in English.

Assessment methods and criteria:

Final exam and approved design 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:

Olli Silven

Working life cooperation:

None.

Other information:

-

521404A: Digital Techniques 2, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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 buildning 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:

1. Logical and physical properties of digital logic components. 2. Representation of digital designs. 3. Combination logic design. 4. Sequential logic design. 5. Digital artithmetics. 6. Semiconductor memories. 7. Register transfer level architecture design. 8. Register transfer level modeling and synthesis. 9. Timing design. 10. Digital interface design. 11. Design verification

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.
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:

-

521288S: Multiprocessor Programming, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521280S	DSP Laboratory Work	5.0 op

ECTS Credits:

5 ECTS cr / 135 hours of work

Language of instruction:

English

Timing:

Spring semester, periods 3-4

Learning outcomes:

Upon completition of the course, the student:
1. has basic understanding of multiprocessor architectures and heterogeneous computing,
2. has basic understanding on how to design and implement algorithms for heterogeneous platforms,

3. understands the possible challenges and shortcomings related to the current heterogeneous systems,

4. is able to use the OpenCL framework for designing, implementing and optimizing signal processing algorithms for heterogeneous platforms

Contents:

Algorithm design, general purpose computing on graphics processing units, heterogeneous computing, OpenCL programming and optimization

Mode of delivery:

Opening lecture and independent exercise project, which is divided into smaller sub-entities. The exercise project is performed using both desktop and mobile platforms. After each sub-entity, a short seminar is held where the students discuss their results and possible ways to optimize the performance of their implementation.

Learning activities and teaching methods:

Opening lecture (2h), seminars (8h) and independent exercise project (125h).

Target group:

Computer Science and Engineering students and other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those interested in signal processing, processor architectures and embedded systems programming.

Prerequisites and co-requisites:

Matrix Algebra 031078P, Elementary programming 521141P, Computer Systems 521286A, Digital Filters 521337A

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:

Students complete the course exercises after the attending to the opening lecture in groups of two students. Assessment is based on the quality of the completed exercises and exercise reports. More detailed information on assessment will be announced at the beginning of the course.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Teemu Nyländen

Working life cooperation:

-

Other information:

-

521423S: Embedded System Project, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Röning

Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

Lecturing in Finnish, material available in English

Timing:

Spring, periods 3-4.

Learning outcomes:

1. After passing the course a student can explain the life cycle of the embedded system, the characteristic features related to embedded systems development, and the risks involved.
2. In addition, the student can explain the roles of the client and the system developer during the requirements specification, and the role of the iteration phase as a part of the requirements specification phase. The student can explain the factors affecting to SW/HW partitioning process, and the concept of SW /HW dualism. The student can fairly analyze the factors affecting to the selection of the processor and the operating system. The student can recognize the basic development tools used and their possible advantages and disadvantages.
3. The student can compare various testing approaches. The student can explain how a design error affects to the final cost of the system in different phases of the development. The student can do some basic I/O programming using C programming language.

Contents:

The embedded design life cycle, the selection process, the partitioning decision, the development environment, the special software techniques, a basic toolset, JTAG/ICE, testing, I/O programming.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

The course is run in a project work in groups of two and follow up the progress reporting meetings. Lectures 20 h, laboratory exercise in period 1-3 120 h.

Target group:

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

Prerequisites and co-requisites:

521412A Digital Techniques I
Also recommended 521275A Embedded Software Project, 521432A Electronics Design I.

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:

Berger, Arnold S. (2002) Embedded Systems Design: An introduction to Processes, Tools, & Techniques, CMP Books, USA. ISBN:1578200733.

Assessment methods and criteria:

Project work.
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:

None.

Other information:

-

521340S: Communications Networks I, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: 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. Upon completing the required coursework, the student is able to list and understand the functionalities of different layers of OSI and TCP/IP protocol models
2. The course gives the skills for the student to explain the mobile network evolution through previous and existing generations of mobile networks (1G, 2G, 3G, and 4G) towards incoming 5G.
3. The student is able to describe the basic protocol model of the UMTS and LTE/LTEA radio interface and radio access network, emerging technologies such as Cloud Radio Access Networks (CRAN), and core network functionalities and entities such as operator network control entities.

4. The student knows the basic properties of routing protocols in fixed, wireless and ad hoc networks.
5. Students will achieve skills to describe the main principles of network programmability, mobility control, and network security.
6. The course also gives the student the ability to explain the essential features of core network elements.
7. The student is able to simulate different types of networks in simulation environments.

Contents:

Communications architecture and protocols, adaptive network and transport layers, mobility management, cellular/multihop cellular networks, network security, network management and ad hoc and sensor networks. Introduction to cloud computing, edge computing, and Mobile Edge Computing, and the concepts of cognitive networks, Software Defined Networks, and Network Function Virtualization. The goal is to present the fundamentals of the new communication architectures, trends and technologies accepted by academia and industry. Technical implementation and application of the common data and local networks are also discussed.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 30 h and the compulsory design work with a simulation program (15 h).

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:

Mainly from: S. Glisic & B. Lorenzo: Wireless Networks: 4G Technologies (2nd ed.), 2009; Partly from S. Glisic: Advanced Wireless Communications: 4G Cognitive and Cooperative Technologies (2nd ed.), 2007; Partly from the book “Software Defined Mobile Networks (SDMN): Beyond LTE Network Architecture” M Liyanage, A Gurtov, M Ylianttila – 2015.

Assessment methods and criteria:

The course is passed with a final examination and the accepted simulation 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:

-

A452271: Advanced Module/Information Technology, Signal Processing (obligatory), 13,5 - 20 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory Courses, 20 ECTS cr

521155S: Computer Security, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Teemu Tokola, Juha Röning
Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits

Language of instruction:

English

Timing:

Autumn semester, period I.

Learning outcomes:

Upon completion of this course, students are familiar with key areas of computer security and have practiced practical skills in these areas with assignments.

Contents:

The course covers the essential aspects of computer security and computer security research in theory and through practical examples.

Mode of delivery:

Lectures and practical assignments

Target group:

The course is intended for computer engineering masters students and additionally to any student interested in computer security that has the sufficient technical background to complete the course exercises.

Prerequisites and co-requisites:

As prior knowledge students should have a basic understanding of how computers and operating systems work and basic skills in programming. Examples of suitable courses to cover these fundamentals are Operating Systems 521453A, Introduction to Programming 521141P and Computer Engineering 521267A.

Recommended optional programme components:

The course is an independent entity.

Recommended or required reading:

-

Assessment methods and criteria:

Grading of the course is made based on the course practical assignments.

Grading:

Numerical scale 1-5, with 0 denoting failure to pass.

Person responsible:

Juha Röning, Teemu Tokola

Working life cooperation:

Visiting lectures from computer security –related companies arranged during the course whenever possible.

Other information:

-

521404A: Digital Techniques 2, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: 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 buildning 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:

1. Logical and physical properties of digital logic components. 2. Representation of digital designs. 3. Combination logic design. 4. Sequential logic design. 5. Digital artithmetics. 6. Semiconductor memories. 7. Register transfer level architecture design. 8. Register transfer level modeling and synthesis. 9. Timing design. 10. Digital interface design. 11. Design verification

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.
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:

-

521281S: Application Specific Signal Processors, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Autumn, period 1.

Learning outcomes:

After completing the course, student
1. Can distinguish the main types of signal processors

2. Can design basic customized transport triggered architecture processors

3. Is capable of assembling a signal processor out of basic entities

4. Can match the processor performance and the application requirements

5. Applies the TTA codesign environment and Altera's FPGA tools to synthesize a system

Contents:

Examples of modern signal processing applications, main types of signal processors, parallel signal processing, transport triggered architectures, algorithm-architecture matching, TCE design environment and Altera FPGA tools.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

Lectures 12h (participation mandatory); Instructed labs 12h. Independent work 111h

Target group:

Computer Science and Engineering students + other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those who are specializing into signal processing.

Prerequisites and co-requisites:

521267A Computer Engineering or 521286A Computer Systems (8 ECTS cr) or 521287A Introduction to Computer Systems (5 ECTS cr) and 521337A digital filters, programming 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:

Handouts.

Assessment methods and criteria:

Participation in mandatory classes and approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Teemu Nyländen

Working life cooperation:

No.

Other information:

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521321S: Elements of Information Theory and Coding, 5 op

Voimassaolo: 14.11.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Rajatheva Rajatheva, Timo Kokkonen

Opintokohteen kielet: English

Leikkaavuudet:

521323S	Wireless Communications 2	5.0 op

ECTS Credits:

5

Language of instruction:

English.

Timing:

Fall, period 2

Learning outcomes:

1. can use basic methodology of information theory to calculate the capacity bounds of communication and data compression systems.

2. can estimate the feasibility of given design tasks before the execution of the detailed design.

3. understands the operating principles of block codes, cyclic codes and convolutional codes.

4. can form an encoder and decoder for common binary block codes, and is capable of using tables of the codes and shift register when solving problems.

5. can represent the operating idea of a convolutional encoder as a state machine.

6. is able to apply the Viterbi algorithm to decoding of convolutional codes.

7. is capable of specifying principles of Turbo, LDPC and Polar coding and coded modulation.

8. can evaluate error probability of codes and knows practical solutions of codes by name.

Contents:

Entropy, mutual information, data compression, basics of source coding, discrete channels and their capacity, the Gaussian channel and its capacity, rate distortion theory, introduction to network information theory, block codes, cyclic codes, burst error correcting codes, error correcting capability of block codes, convolutional codes, Viterbi algorithm, concatenated codes, and introduction to Turbo, LDPC and Polar coding and to coded modulation.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-to-face teaching (lectures and exercises) 64 h and group working.

Target group:

1st year WCE-RAN students and M.Sc. students (i.e., 4th year in EE degree programme)

Prerequisites and co-requisites:

Signal Analysis, Telecommunication Engineering

Recommended optional programme components:

Wireless Communications I and the course support each other. Their simultaneous studying is recommended.

Recommended or required reading:

Parts from books Thomas M. Cover & Joy A. Thomas: Elements of Information Theory, 2nd ed. John Wiley & Sons, 2006 ISBN-13 978-0-471-24195-9, ISBN-10 0-471-24195-4, and S. Benedetto and E. Biglieri: Principles of Digital Transmission with Wireless Applications, 1999, Chapters 3, 10 and in part 11 and 12. Lecture notes and other literature.

Assessment methods and criteria:

The course is passed with weekly exams (only during lecture periods) or with final exam and possible additional course tasks defined in the beginning of the course.

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:

Timo Kokkonen (Coding) / Nandana Rajatheva (Information theory)

Working life cooperation:

No

Other information:

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A452272: Advanced Module/Information Technology, Signal Processing (optional), 15 - 22 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses: , Choose from the following 22 ECTS cr. Studies that have been completed in the other land can be placed here.

521323S: Wireless Communications I, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Jari Iinatti

Opintokohteen kielet: English

Leikkaavuudet:

521395S-01	Wireless Communications I, Exam	0.0 op
521395S	Wireless Communications I	5.0 op
521320S	Wireless Communications I	8.0 op
521320S-01	Intermediate exam or final exam, Wireless Communications 2	0.0 op
521320S-02	Exercise work, Wireless Communications 1	0.0 op

ECTS Credits:

5 ECTS cr / lecture 28 h, exercises 14 h and the compulsory design work with a simulation program (20 h)

Language of instruction:

English

Timing:

Fall, period 2

Learning outcomes:

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 the suitable diversity methods for fading channel and related combining methods
4. can define the basic carrier and symbol synchronization methods and is able to make the performance comparison of them
5. can explain design methods signals for band-limited channels
6. can classify different channel equalizers, and perform the performance analysis

Contents:

Digital modulation methods and their performance in AWGN-channel, radio channel models, performance of digital modulation in fading channel, diversity techniques, channel equalizers in wireless communication channel, carrier and symbol synchronization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h, exercises 14 h 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 EE degree programme)

Prerequisites and co-requisites:

521330A Telecommunication Engineering 521316S Broadband Communications Systems

Recommended optional programme components:

-

Recommended or required reading:

Parts of book: Andrea Goldsmith: Wireless Communications, Cambridge University Press, 2005. Parts of book: J.G. Proakis: Digital Communications, 4th ed, McGraw Hill, 2001.

Assessment methods and criteria:

The course is passed with a final examination and the accepted design work report. In the final grade of the course, the weight for the examination 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

Working life cooperation:

No

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 Seppänen
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 50 hours of work

Language of instruction:

English. Examination can be taken in English or Finnish.

Timing:

The course unit is held in the autumn semester, during period 2. It is recommended to complete the course at the end of studies.

Learning outcomes:

After completing the course, student
1. knows special characteristics of the biosignals and typical signal processing methods
2. can solve small-scale problems related to biosignal analysis
3. implement small-scale software for signal processing algorithms

Contents:

Biomedical signals. Digital filtering. Analysis in time-domain and frequency domain. Nonstationarity. Event detection. Signal characterization.

Mode of delivery:

Face-to-face teaching and guided laboratory work.

Learning activities and teaching methods:

Lectures 10h, Laboratory work 20h, Self-study 20h, written examination.

Target group:

Students interested in biomedical engineering, at their master's level studies.
Students of the University of Oulu.

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:

Laboratory work is supervised by assistants who also check that the task assignments are completed properly. All task assignments are compulsory. The course ends with a written exam.
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.

Other information:

-

477607S: Advanced Control and Systems Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ikonen, Mika Enso-Veitikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

470444S	Advanced Control Methods	6.0 op

ECTS Credits:

5 ECTS, 135 h 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

Learning outcomes:

After completing the course the student can design the model based control systems, can formulate and solve state estimation problems, and discover research trends in control and systems engineering

Contents:

1. Model-based control: as DMC, QDMC; GPC. 2. State estimations: as Kalman filtering and particle filters. 3. Active research directions (elected annually)

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and demonstration exercises

Target group:

M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477621A Control system analysis, 477622A Control system design and 477624S Control system methods recommended beforehand

Recommended or required reading:

Materials distirbuted during the contact teaching and through the course web pages

Assessment methods and criteria:

Exam and homework

Grading:

Numerical grading scale 1.5 or fail

Person responsible:

Professor Enso Ikonen

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
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:

Professor Timo Ojala.

Working life cooperation:

-

521324S: Statistical Signal Processing II, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

Opintokohteen kielet: English

Leikkaavuudet:

521373S Communication Signal Processing I 6.0 op

521373S-01 Exam, Communication Signal Processing I 0.0 op

521373S-02 Statistical Signal Processing 2, exercise work 0.0 op

ECTS Credits:

5

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 1st spring semester of the master studies.

Learning outcomes:

Upon completion the student will
1. understand the key design problems and constraints of the design of baseband parts of a communications transceiver.
2. have the skills to apply estimation, detection and other statistical signal processing methods to communications transceiver and system design.
3. can use linear algebra, basics of optimization and statistical signal processing to derive receiver algorithms, in particular for soft output equalization/detection and receiver synchronization.
4. can use numerical analysis to approximate optimal algorithms with iterative solutions including (un) supervised adaptive algorithms.
5. understands the basic requirements for the convergence of an iterative and adaptive algorithm.
6. can model the operation of a transceiver using Matlab and other simulators to assess the performance of transceiver algorithms.

Contents:

Review of linear algebra, matrix computations and basics of constrained optimization; transceiver baseband design targets, filter optimization, adaptive filters and algorithms, iterative algorithms, algorithm convergence, equalization and detection algorithms, channel estimation, receiver carrier and timing synchronization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-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 Statistics, 031078P Matrix algebra, 521330A Telecommunication engineering, 521348S Statistical signal processing. The recommended prerequisite is the completition of 521323S Wireless communications I.

Recommended optional programme components:

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Recommended or required reading:

Parts from books:
1. Prandoni, Paolo & Vetterli, Martin, “Signal Processing for Communications”, CRC Press 2008.
2. Haykin, Simon, Adaptive Filter Theory, 3rd ed. or newer, Prentice Hall 1996.
3. Kailath, Thomas, Sayed, Ali H. & Hassibi, Babak, “Linear Estimation”, Prentice Hall 2000.
4. Golub, Gene H. & Van Loan, Charles F., “Matrix computations”, 3rd ed. or newer, Johns Hopkins University Press 1996.

5. Meyr, Heinrich, Moeneclaey, Marc & Fechtel, Stefan A., Digital Communication Receivers: Synchronization, Channel, Estimation and Signal Processing. John Wiley, 1998
Other literature, lecture notes and material.

Assessment methods and criteria:

Continuous evaluation by solving homework problems and completing the simulation projects, and a final 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 (0) stands for a fail.

Person responsible:

Markku Juntti

Working life cooperation:

No

Other information:

-

521493S: Computer Graphics, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiaopeng Hong, Yingyue Xu, Guoying Zhao

Opintokohteen kielet: English

Leikkaavuudet:

521140S	Computer Graphics	5.0 op

ECTS Credits:

7 ECTS credits

Language of instruction:

In English.

Timing:

Spring, period 4.

Learning outcomes:

Upon completion of the course, the student:
1. is able to specify and design 2D graphics algorithms including: line and circle drawing, polygon filling and clipping
2. is able to specify and design 3D computer graphics algorithms including transformations, viewing, hidden surface removal, shading, texture mapping and hierarchical modeling
3. is able to explain the relationship between the 2D and 3D versions of such algorithms
4. possesses the necessary basic skills to use these basic algorithms available in OpenGL

Contents:

The history and evolution of computer graphics; 2D graphics including: line and circle drawing, polygon filling, clipping, and 3D computer graphics algorithms including viewing transformations, shading, texture mapping and hierarchical modeling; graphics API (OpenGL) for implementation.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures 30 h / Self-study and programming assignments 104h.

Target group:

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

Prerequisites and co-requisites:

Programming skills using C++; basic data structures; simple linear algebra. Additionally recommended prerequisite is the completion of the following course prior to enrolling for course unit: 521267A Computer Engineering or 521286A Computer Systems or 521287A Introduction to Computer Systems

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:

1) Textbook: Edward Angel, Dave Shreiner: Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, Addison-Wesley 2015
2) Textbook: Edward Angel: Interactive Computer Graphics, 5th Edition, Addison-Wesley 2008
3) Reference: Peter Shirley, Michael Ashikhmin, Michael Gleicher, et al. : Fundamentals of Computer Graphics, second edition, AK Peters, Ltd. 2005
4) Lecture notes (in English)
5) Materials in the internet (e.g. OpenGL redbook) OpenGL Programming Guide or 'The Red Book': http://unreal.srk.fer.hr/theredbook/ OpenGL Video Tutorial: target=_blank>http://www.videotutorialsrock.com/opengl_tutorial/what_is_opengl/text.php

Assessment methods and criteria:

The assessment of the course is based on the exam (50%) and returned course work (50%).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5, zero stands for fail.

Person responsible:

Guoying Zhao, Xiaopeng Hong, Yingyue Xu

Working life cooperation:

No

Other information:

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521445S: Digital Techniques 3, 6 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Lahti

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

521325S: Communication Signal Processing, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

Opintokohteen kielet: English

Leikkaavuudet:

521360S	Synchronisation for Digital Receivers	4.0 op

521360S-01	Synchronization for Digital Receivers, exam	0.0 op
521360S-02	Synchronisation for Digital Receivers, exercise work	0.0 op

ECTS Credits:

5 ECTS cr / 130 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 1st spring semester of the master studies.

Learning outcomes:

Upon completion the student

1. knows the functional structure of communications transceiver and understands the requirements for various wireless systems for the transceiver.
2. knows the architectural and functional design of (all-)digital transceiver with synchronization, channel estimation and connection establishment.
3. can derive digital domain algorithms for separate functionalities and match them to operate together via agreed interfaces.
4. can model the operation of the algorithms and the whole transceiver using Matlab and C other to assess their performance by computer simulations.
5. knows how to interface the software models to the common implementation architectures.

Contents:

Wireless transceiver functional split, digital parts and architecture, multirate filtering, transceiver digital front-end architecture and design, algorithm-architecture co-simulation.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-face-teaching (lectures and exercises) 25h, Simulation and design exercises in groups 80 h, independent work & passed assignment 35 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 Statistics, 031078P Matrix algebra, 521330A Telecommunication engineering, 521348S Statistical signal processing, 521324S Communications signal processing I. The recommended prerequisite is the completition of 521323S Wireless communications I.

Recommended optional programme components:

-

Recommended or required reading:

Parts from books:
1. Prandoni, Paolo & Vetterli, Martin, “Signal Processing for Communications”, CRC Press 2008.
2. P. P. Vaidyanathan, S.-M. Phoong & Y.-P. Lin, Signal Processing and Optimization for Transceiver Systems, Cambridge University Press, 2010.
3. Meyr, Heinrich, Moeneclaey, Marc & Fechtel, Stefan A., Digital Communication Receivers: Synchronization, Channel, Estimation and Signal Processing. John Wiley, 1998
Other literature, lecture notes and material.

Assessment methods and criteria:

Continuous evaluation by solving homework problems and completing the simulation projects, and a final 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 (0) stands for a fail.

Person responsible:

Markku Juntti

Working life cooperation:

The project focuses on timely design problems in wireless industry. Industrial visiting lectures are organized.

Other information:

-

A452273: Advanced Module/Information Technology, Intelligent Systems (obligatory), 14 - 17 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521493S: Computer Graphics, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiaopeng Hong, Yingyue Xu, Guoying Zhao

Opintokohteen kielet: English

Leikkaavuudet:

521140S	Computer Graphics	5.0 op

ECTS Credits:

7 ECTS credits

Language of instruction:

In English.

Timing:

Spring, period 4.

Learning outcomes:

Upon completion of the course, the student:
1. is able to specify and design 2D graphics algorithms including: line and circle drawing, polygon filling and clipping
2. is able to specify and design 3D computer graphics algorithms including transformations, viewing, hidden surface removal, shading, texture mapping and hierarchical modeling
3. is able to explain the relationship between the 2D and 3D versions of such algorithms
4. possesses the necessary basic skills to use these basic algorithms available in OpenGL

Contents:

The history and evolution of computer graphics; 2D graphics including: line and circle drawing, polygon filling, clipping, and 3D computer graphics algorithms including viewing transformations, shading, texture mapping and hierarchical modeling; graphics API (OpenGL) for implementation.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures 30 h / Self-study and programming assignments 104h.

Target group:

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

Prerequisites and co-requisites:

Programming skills using C++; basic data structures; simple linear algebra. Additionally recommended prerequisite is the completion of the following course prior to enrolling for course unit: 521267A Computer Engineering or 521286A Computer Systems or 521287A Introduction to Computer Systems

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:

1) Textbook: Edward Angel, Dave Shreiner: Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, Addison-Wesley 2015
2) Textbook: Edward Angel: Interactive Computer Graphics, 5th Edition, Addison-Wesley 2008
3) Reference: Peter Shirley, Michael Ashikhmin, Michael Gleicher, et al. : Fundamentals of Computer Graphics, second edition, AK Peters, Ltd. 2005
4) Lecture notes (in English)
5) Materials in the internet (e.g. OpenGL redbook) OpenGL Programming Guide or 'The Red Book': http://unreal.srk.fer.hr/theredbook/ OpenGL Video Tutorial: target=_blank>http://www.videotutorialsrock.com/opengl_tutorial/what_is_opengl/text.php

Assessment methods and criteria:

The assessment of the course is based on the exam (50%) and returned course work (50%).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5, zero stands for fail.

Person responsible:

Guoying Zhao, Xiaopeng Hong, Yingyue Xu

Working life cooperation:

No

Other information:

-

521285S: Affective Computing, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Guoying Zhao

Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

Language of instruction:

English

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:

After completing the course, student

1. is able to explain the emotion theory and modeling

2. is able to implement algorithms for emotion recognition from visual and audio signals or the fusion of multi-modalities

3. has the ideas of wide applications of affective computing

Contents:

The history and evolution of affective computing; psychological study about emotion theory and modeling; emotion recognition from different modalities: facial expression, speech, EEG; crowdsourcing study; synthesis of emotional behaviors; emotion applications.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

The course consists of lectures and exercises. The final grade is based on the points from exam while there are several mandatory exercises.

Target group:

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

Prerequisites and co-requisites:

A prior programming knowledge, possibly the bachelor level mathematical studies and/or some lower level intermediate studies (e.g. computer engineering or artificial intelligence courses). The recommended optional studies include the advanced level studies e.g. the pattern recognition and neural networks and/or computer vision courses.

Recommended optional programme components:

-

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment of the course is based on the exam (100%) with mandatory exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Guoying Zhao, Eero Väyrynen, Xiaohua Huang

Working life cooperation:

-

Other information:

-

521156S: Towards Data Mining, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Tamminen, Heli Koskimäki

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish or English

Timing:

Autumn, period I.

Learning outcomes:

Student can recognize the type of the data before further analysis and the required preprocessing. The concrete learning outcomes are:

1. Student can design and implement the data gathering
2. Student can combine data from different sources
3. Student can normalize and transfor data, and handle missing or incorrect data.
4. Student can ensure the 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:

16h lectures, 16h 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:

Participation in mandatory classes and 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 and Koskimäki Heli

Working life cooperation:

-

Other information:

-

A452274: Advanced Module/Information Technology, Intelligent Systems (optional), 18 - 25 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, Choose from the following 25 ECTS cr. Studies that have been completed in the other land can be placed here.

521290S: Distributed Systems, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiang Su

Opintokohteen kielet: Finnish

Leikkaavuudet:

521266S-01	Distributed Systems, Exam	0.0 op
521266S-02	Distributed Systems, Exercise Work	0.0 op
521266S	Distributed Systems	6.0 op

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Spring, period 3.

Learning outcomes:

After completing the course, the student
1. is able to explain the key principles of distributed systems
2. apply the principles in evaluating major design paradigms used in implementing distributed systems
3. solve distributed systems related problems
4. design and implement a small distributed system

Contents:

Introduction, architectures, processes, communication, naming, synchronization, consistency and replication, fault tolerance, security, case studies.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

Lectures 22 h, exercises 16 h, project work 50 h, self-study 47 h.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu

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:

Required literature: Maarten van Steen and Andrew S. Tanenbaum, Distributed Systems – Principles and Paradigms, Third Edition, 2017.

Assessment methods and criteria:

The course uses continuous assessment so that there are 2 intermediate exams. Alternatively, the course can also be passed with a final exam. The course includes a mandatory project work.

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

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Professor Timo Ojala

Working life cooperation:

None.

Other information:

-

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: Seppo Honkanen

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:

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 students can identify the problems of the sampled data systems, and know how to apply discrete time methods for systems analysis and control design.

Contents:

1. Control systems design by frequency-response methods. 2. Control systems design in state space methods 3. Sampled data systems: sampling, Z transformation of signals. 4. Discrete-time modelling: difference equation, shift operator, pulse transfer function, polynomial and state-space description. 5. Analysis of discrete-time systems: z-plane, stability. 6. Discrete-time control design strategies: general RST structure, various pole-zero placement control algorithms, minimum-variance control, model-based control, state-space design methods.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and exercises include 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 recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout. Dorf, R. (2010) Modern Control Systems. Prentice-Hall, New York, 1104 s, Ogata, K (2002) Modern Control Engineering. Prentice-Hall, New York, 964 s., Åström, K & Murray, R. (2009) Feedback Systems, An Introduction for Scientists and Engineers. Princeton University Press, New Jersey, 396 s., Landau, I. & Zito, G. (2005) Digital Control Systems, Springer. 485 pp. Åström, K.J. & Wittenmark, B. (1984, 1997) Computer Controlled Systems: Theory and Design. Prentice-Hall International. 544 pp.

Assessment methods and criteria:

Final written exam; to request an exam in English, contact the lecturer via email beforehand.

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

University teacher Seppo Honkanen

Working life cooperation:

No

Other information:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
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:

Professor Timo Ojala.

Working life cooperation:

-

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 Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 50 hours of work

Language of instruction:

English. Examination can be taken in English or Finnish.

Timing:

The course unit is held in the autumn semester, during period 2. It is recommended to complete the course at the end of studies.

Learning outcomes:

After completing the course, student
1. knows special characteristics of the biosignals and typical signal processing methods
2. can solve small-scale problems related to biosignal analysis
3. implement small-scale software for signal processing algorithms

Contents:

Biomedical signals. Digital filtering. Analysis in time-domain and frequency domain. Nonstationarity. Event detection. Signal characterization.

Mode of delivery:

Face-to-face teaching and guided laboratory work.

Learning activities and teaching methods:

Lectures 10h, Laboratory work 20h, Self-study 20h, written examination.

Target group:

Students interested in biomedical engineering, at their master’s level studies.
Students of the University of Oulu.

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:

Laboratory work is supervised by assistants who also check that the task assignments are completed properly. All task assignments are compulsory. The course ends with a written exam.
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.

Other information:

-

477607S: Advanced Control and Systems Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ikonen, Mika Enso-Veitikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

470444S	Advanced Control Methods	6.0 op

ECTS Credits:

5 ECTS, 135 h 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

Learning outcomes:

After completing the course the student can design the model based control systems, can formulate and solve state estimation problems, and discover research trends in control and systems engineering

Contents:

1. Model-based control: as DMC, QDMC; GPC. 2. State estimations: as Kalman filtering and particle filters. 3. Active research directions (elected annually)

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and demonstration exercises

Target group:

M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477621A Control system analysis, 477622A Control system design and 477624S Control system methods recommended beforehand

Recommended or required reading:

Materials distirbuted during the contact teaching and through the course web pages

Assessment methods and criteria:

Exam and homework

Grading:

Numerical grading scale 1.5 or fail

Person responsible:

Professor Enso Ikonen

802633S: Statistical Pattern Recognition, 10 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Lasse Holmström

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

521283S: Big Data Processing and Applications, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ekaterina Gilman

Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

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 fundatmenals, data storage, batch and stream data processing, data analysis, privacy and security, big data use cases.

Mode of delivery:

Face-to-face teaching, 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, the exercises do not require programming skills but they are an advantage.

Recommended optional programme components:

Finishing 521290S Distributed Systems, 521497S Pattern recognition and neural networks, and 521286A Computer Systems is beneficial.

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 exercises, seminar presentations and short reports on a selected topic (group work), and answering two quizzes during the course. To pass the course, it is enough to get 50% of available points for each part. No exam.

Grading:

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

Person responsible:

Ekaterina Gilman

Working life cooperation:

The course includes also invited lectures from industry.

Other information:

-

477525S: Computational intelligence in automation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Aki Sorsa, Esko Juuso

Opintokohteen kielet: Finnish

Leikkaavuudet:

477505S	Fuzzy-neuromethods in Process Automation	4.0 op

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation in the spring term, on the 3rd period. Recommended for 4th year students (first M.Sc. year)

Learning outcomes:

After the course the student is capable of explaining the concepts of intelligent systems and operation principles of fuzzy set systems, neural networks, neuro-fuzzy systems and evolutionary computation. The student has skills to construct and tune fuzzy models in Matlab-Simulink environment and to explain the operation of these models. The student is able to explain in an integrating way the principle concepts of neural computing and construct neural network models in Matlab-Simulink environment. The student recognizes the key problems of the data-driven modelling and is able to choose suitable solutions which ensure generalization. The student is able to explain the operation principles of genetic algorithms and to use them in tuning of fuzzy set systems and neural network models. Moreover, the student is able to describe alternative solutions for dynamic models, hyperplane methods and hybrid solutions. The student can explain the key concepts of cellular automata and evolutionary computation. After the course the student is able to search other relevant programming tools.

Contents:

Fuzzy logic and fuzzy set systems, fuzzy calculus, fuzzy modeling and control, neural computation, learning algorithms, neuro-fuzzy methods, linguistic equations, evolutionary computation, hyperplane methods, cellular automata, intelligent diagnostics and decision making, adaptive intelligent systems, hybrid systems.

Mode of delivery:

Tuition is implemented mainly as face-to-face teaching.

Learning activities and teaching methods:

The amount of guided teaching is 32 hrs, including lectures (16), exercises (10) and seminars 6). Totally 58 hrs are allocated for self-study, which consists of three parts: (1) a case study covering several topics applied in a chosen problem, (2) a seminar work concentrating on a single topic, and (3) the final report.

Target group:

M.Sc. students in process and environmental engineering, machine engineering, computer engineering and industrial engineering and management.

Prerequisites and co-requisites:

No specific prerequisites, but skills for simulation, and programming in Matlab are a benefit. See "Recommended optional programme components" below.

Recommended optional programme components:

Courses Simulation, and Programming in Matlab reinforce abilities for the exercises and the case study

Recommended or required reading:

Lecture notes and exercise materials. Material is in Finnish and in English.

Assessment methods and criteria:

The assessment of the course is based on the exercises, case study, seminar and the final report. Final exam is an alternative for the final report.
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 uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. (Tech.) Esko Juuso

Working life cooperation:

No

Other information:

-

A452275: Advanced Module/Information Technology, Biomedical Information Engineering (obligatory), 11 - 20 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521284S: Biomedical Engineering Project, 5 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Seppänen
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits

Language of instruction:

English.

Timing:

As part of the master level studies, in any period suitable to the student.

Learning outcomes:

1. has develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work and the interests of student. Main emphasis is on the development and application of methods and algorithms for biomedical data processing. Often the work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study under supervision.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, and documentation. Task assignments can be applied at any time all year round.

Target group:

Master-level students that are interested in biomedical engineering. Students of the University of Oulu.

Prerequisites and co-requisites:

The mathematic studies of the candidate degree program of computer science and engineering, or equivalent. Courses such as Biosignal processing I and II, Biomedical image processing and Machine learning are recommended. Programming skills, especially 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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report.
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

Other information:

-

521093S: Biomedical Instrumentation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Igor Meglinski

Opintokohteen kielet: Finnish

Leikkaavuudet:

521107S	Biomedical Instrumentation	6.0 op

ECTS Credits:

5

Language of instruction:

English.

Timing:

Period 3.

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 effects of electric current 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). Bioelectrical measurements (EKG, EEG, EMG, EOG, ERG), blood pressure and flow meters, respiration studies, measurements in a clinical laboratory, introduction to medical imaging methods and instruments, ear measurements, heart pacing and defibrillators, physical therapy devices, intensive care and operating room devices and electrical safety aspects.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures/exercises 42 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:

R. S. Khandpur: Biomedical Instrumentation, Technology and Applications, McGraw-Hill, 2005 and J. G. Webster: Medical Instrumentation, Application and Design, 4th edition, John Wiley & Sons, 2010.

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:

Igor Meglinski

Working life cooperation:

No.

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 Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 50 hours of work

Language of instruction:

English. Examination can be taken in English or Finnish.

Timing:

The course unit is held in the autumn semester, during period 2. It is recommended to complete the course at the end of studies.

Learning outcomes:

After completing the course, student
1. knows special characteristics of the biosignals and typical signal processing methods
2. can solve small-scale problems related to biosignal analysis
3. implement small-scale software for signal processing algorithms

Contents:

Biomedical signals. Digital filtering. Analysis in time-domain and frequency domain. Nonstationarity. Event detection. Signal characterization.

Mode of delivery:

Face-to-face teaching and guided laboratory work.

Learning activities and teaching methods:

Lectures 10h, Laboratory work 20h, Self-study 20h, written examination.

Target group:

Students interested in biomedical engineering, at their master's level studies.
Students of the University of Oulu.

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:

Laboratory work is supervised by assistants who also check that the task assignments are completed properly. All task assignments are compulsory. The course ends with a written exam.
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.

Other information:

-

521282S: Biosignal Processing II, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Kortelainen

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS cr

Language of instruction:

Lectures and laboratory works are given in English. The examination can be taken in Finnish or English.

Timing:

Period 4

Learning outcomes:

After completing the course, student
1. knows the special characteristics of neural signals and the typical signal processing methods related to them

2. can solve advanced problems related to the neural signal analysis

Contents:

Introduction to neural signals, artifact removal, anesthesia and natural sleep, topographic analysis and source localization, epilepsy, evoked potentials.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (8 h) and laboratory work (20 h), written exam.

Target group:

Engineering students, medical and wellness technology students, and other students interested in biomedical engineering. Students of the University of Oulu.

Prerequisites and co-requisites:

The basic engineering math courses, digital filtering, programming skills, Biosignal Processing I.

Recommended optional programme components:

-

Recommended or required reading:

The course is based on selected parts from books "EEG Signal Processing", S. Sanei and J. A. Chambers, "Bioelectrical Signal Processing in Cardiac and Neurological Applications", L. Sörnmo and P. Laguna, and "Neural Engineering", B. He (ed.) as well as lecture slides and task assignment specific material.

Assessment methods and criteria:

Laboratory work is supervised by the assistants who will also check that the task assignments are completed properly. The course ends with a written exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading of the accepted exam is in the range 1-5.

Person responsible:

Jukka Kortelainen

Working life cooperation:

-

Other information:

-

A452276: Advanced Module/Information Technology, Biomedical Information Engineering (optional), 20 - 24 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, Choose from the following 22 ECTS cr. Studies that have been completed in the other land can be placed here.

764634S: Medical physics and imaging, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Miika Nieminen

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

757314A: Basics of bioinformatics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Biology

Arvostelu: 1 - 5, pass, fail

Opettajat: Lumi Viljakainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

750340A	Basics of bioinformatics	3.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

Finnish / English.

Timing:

B.Sc. studies, 3rd autumn.

Learning outcomes:

After the course the student can explain and is able to use the basic methods for handling nucleotide and protein sequences. Student learns how to use various databases, can explain the background and principles of the analytic methods, is able to take up a critical attitude towards the used methods and gets a good background for applying new methods that are developed continuously.

Contents:

Searching DNA and protein sequences and information connected to the sequences from various databases, genome structure and sequence-based gene prediction and annotation, sequence alignment, introduction to next-generation sequencing techniques.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

12 h lectures, 2 h seminar, 20 h exercises, independent work.

Target group:

BT: compulsory, recommended for all biologists. Suitable also for biochemists.

Prerequisites and co-requisites:

Concepts of genetics (757109P) or equivalent knowledge, also Molecular evolution (757312A) is recommended.

Recommended optional programme components:

-

Recommended or required reading:

Pevsner, J. 2015: Bioinformatics and functional genomics, Wiley-Blackwell.
The availability of the literature can be checked from this link.

Assessment methods and criteria:

Take-home exam, exercises, seminar presentation, independent work and student activity.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 / Fail.

Person responsible:

Doc. Lumi Viljakainen.

Working life cooperation:

No.

Other information:

-

521285S: Affective Computing, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Guoying Zhao
Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

Language of instruction:

English

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:

After completing the course, student
1. is able to explain the emotion theory and modeling

2. is able to implement algorithms for emotion recognition from visual and audio signals or the fusion of multi-modalities

3. has the ideas of wide applications of affective computing

Contents:

The history and evolution of affective computing; psychological study about emotion theory and modeling; emotion recognition from different modalities: facial expression, speech, EEG; crowdsourcing study; synthesis of emotional behaviors; emotion applications.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

The course consists of lectures and exercises. The final grade is based on the points from exam while there are several mandatory exercises.

Target group:

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

Prerequisites and co-requisites:

A prior programming knowledge, possibly the bachelor level mathematical studies and/or some lower level intermediate studies (e.g. computer engineering or artificial intelligence courses). The recommended optional studies include the advanced level studies e.g. the pattern recognition and neural networks and/or computer vision courses.

Recommended optional programme components:

-

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment of the course is based on the exam (100%) with mandatory exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Guoying Zhao, Eero Väyrynen, Xiaohua Huang

Working life cooperation:

-

Other information:

-

521097S: Wireless Measurements, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Saarela
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 Finnish or in English if two or more foreign students participate.

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 15-20 minutes presentation to other students in the seminars.

Target group:

Master level students regardless of master's programme.

Prerequisites and co-requisites:

No prerequirements, 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:

Juha Saarela

Working life cooperation:

No.

080920S: Diagnostic Imaging, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Miika Nieminen
Opintokohteen kielet: English

ECTS Credits:

5 ECTS credit points / 135 hours of work

Language of instruction:

English

Timing:

Master studies, Autumn 2017, 1st and 2nd periods

Learning outcomes:

The student is able to define the physical principles on which various medical imaging devices are based upon.

Contents:

The course acquaints the students to the basic physics related to imaging modalities and therapeutic systems used in hospitals. Covered topics include e.g. x-ray imaging, computed tomography, magnetic resonance imaging, nuclear medicine and methods of clinical neurophysiology.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 26h, demonstrations 8h, excercises 4h, independent studying and preparing reports 97h. Final exam.

Target group:

Biomedical Engineering MSc students (medical technology, information technology, and other related degree programs), Physics MSc students (biophysics/medical physics) and other minor subject students. Also for the other students of the University of Oulu.

Prerequisites and co-requisites:

Recommended: physics basic courses and Radiation physics, biology and safety (766116P, 761116P, 764117P or 764317A).

Recommended optional programme components:

BME-courses

Recommended or required reading:

Dowsett, Kenny, Johnston: The Physics of Diagnostic Imaging, 2nd ed., Hodder Arnold, 2006.

Assessment methods and criteria:

Taking part in the lectures and demos. Written report on demonstrations. Final 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:

Professor Miika Nieminen

Working life cooperation:

Demonstrations are held in hospital environment and are related to diagnostics.

080926A: Introduction to Biomedical Imaging Methods, 1 - 3 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

1-3 ECTS credit points / 27-81 hours of work.

Language of instruction:

English

Timing:

Master studies, 3rd or 4th period.

Learning outcomes:

The student understands and can describe the basic principles and main applications of imaging methods used in biomedical research.

Contents:

Differences between in vivo, ex vivo and in vitro imaging. Light and electron microscopy. Optical projection and coherence tomography. Optical in vivo imaging. Magnetic resonance imaging. Fourier transform infrared imaging spectroscopy. Raman imaging spectroscopy. Micro-computed tomography. Ultrasound imaging. Basics of image analysis and interpretation

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Scope of the course and the methods of implementation vary. The course includes lectures 16h and demonstrations 8h. Independent study is determined by the extent of the course to 3-57 hours. The course includes a final exam.

Target group:

All students who are interested in methods of biomedical imaging. The course is suitable for both Master and Doctoral students.

Recommended or required reading:

Required literature is given in the lectures.

Assessment methods and criteria:

Participation in the lectures and demonstrations (compulsory). Written exam (3 ECTS). The course can be taken as 1, 2 or 3 ECTS.
1 ECTS # participation in all the lectures
2 ECTS # participation in all the lectures and demonstrations
3 ECTS # participation in the lectures and demonstrations + final exam
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The 1 and 2 ECTS courses utilize verbal grading: pass or fail. The 3 ECTS course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral researcher Lassi Rieppo

A452286: Advanced module/Applied computing technology (optional), 25 - 40 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, Choose from the following 35 ECTS cr. Studies that have been completed in the other land can be placed here.

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
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:

Professor Timo Ojala.

Working life cooperation:

-

812342A: Object Oriented Analysis and Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay812342A	Object Oriented Analysis and Design (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

Finnish. If at least four non-Finnish students take the course, an English exercise group will be organised.

Timing:

The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd autumn semester.

Learning outcomes:

After completing the course, the students know possibilities of UML-language family to describe different views. They can picture a task using Use
cases and scenarios. Moreover they can produce detailed descriptions using activity-, class-, interaction- and state diagrams. They know
principles of object-orientedness and can use abstract as well interface classes. Additionally they can model user interface by state diagrams. They
understand what design patterns are and how they are described and categorised.

Contents:

Principles of object orientation and object-oriented programming; quality criteria of object orientation; design patterns; case use; activity, class, interaction and state machine diagrams; class realisation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures (in Finnish) 30h, exercises and assignments 28h, independent work 85 h

Target group:

Bachelor students.

Prerequisites and co-requisites:

Elementary course of object-oriented programming is a compolsory prerequisite. Basic knowledge of object programming and information systems analysis and design are assumed.

Recommended or required reading:

Bennet, McRobb & Farmer: Object-oriented systems analysis and design, Using UML.

Assessment methods and criteria:

Examination. At least 50% on points needed for passing the course.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Juha Iisakka

812341A: Object-Oriented Programming, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Räsänen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay812341A	Object-oriented Programming (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.

Learning outcomes:

• After completing the course, the student is able to explain the general objectives and techniques of object-oriented programming paradigm. • Furthermore, the student can describe the practical meaning of concepts of object-oriented programming. • The student can construct Java programs that apply inheritance, composition, and polymorphism.

Contents:

Introduction to object-orientation, Basics of programming in Java language, Composition, inheritance and polymorphism, Java collections and exception handling.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 32 h, laboratory exercises 21 h, weekly assignments and independent work 82 h

Target group:

BSc students.

Prerequisites and co-requisites:

Course Introduction to Programming or similar knowledge.

Recommended or required reading:

Timothy Budd: Introduction to object-orientedprogramming, 3rd edition.
Bruce Eckel: Thinkingin Java 3rd edition or later.

Assessment methods and criteria:

Weekly assignments (preferred) or final exam + programming assignment.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Ilkka Räsänen

812331A: Interaction Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Netta Iivari

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 1. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:

Objective: The course explains the role of human interaction with IT products, systems, and services, explains the factors and problems related to it to motivate interaction design, and teaches some user-centered methods for analysis, evaluation and design of interactions.
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:

Face-to-face teaching, self-study

Learning activities and teaching methods:

Lectures 20 h, exercises and seminar 25 h, individual and group assignments 90 h; or self-study: an opening lecture 2 h, one larger
assignment 110 h and individual tasks 21 h.

Target group:

MSc students

Prerequisites and co-requisites:

Basic knowledge on human-computer interaction with usability and user-centered design.

Recommended or required reading:

Sharp et al. (2015) Interaction Design, chapters 1-2, 4-5, 7-13 (pages 1-64, 100-157, 226-473)

Assessment methods and criteria:

Accepted assignments.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Netta Iivari

Working life cooperation:

Invited lectures, assignments

Other information:

The course book will be available in electronic format that would be very useful, as the book is updated regularly and we are using a very old
version.

815657S: Open Source Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

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 periods 1 and 2.It is recommended to complete the course in the 1st autumn semester.

Learning outcomes:

After passing the course, a student will be able to - define the historical background and the ideology of Open Source Software (OSS), - participate in an OSS development project, - evaluate the impact of the usage of OSS and OSS licenses on software development and exploitation, and - view the phenomenon through the essential scientific research.

Contents:

The course introduces OSS development paradigm and current topics in OSS research. OSS affects both the way to produce software and the decisions of user organizations. It can be understood, for example, from different social, legal, economical, software engineering and data security viewpoints. The aim is to study from different perspectives, for example, what OSS is and what it is not, the history and organisation of OSS projects, methods of OSS development and usage, as well as licensing models and possible risks. The emphasis is on research work.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures and seminars about 40 h, exercises and peer reviews about 20 h, seminar article and presentation about 70 h

Target group:

MSc students

Prerequisites and co-requisites:

Compulsory prerequisites are Bachelor degree or other equivalent degree and basic knowledge on software engineering and research work.

Recommended or required reading:

Fogel, K. (2005): Producing Open Source Software - How to Run a Successful Free Software Project, O'Reilly Media; Rosen L. (2004): Open Source Licensing: Software Freedom and Intellectual Property Law, Prentice Hall; scientific articles covering the topic.

Assessment methods and criteria:

Active participation, seminar article and other assignments

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Henrik Hedberg

815305A: Real Time Distributed Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Pulli

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 133 hours of work.

Timing:

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

Learning outcomes:

After completing the course, the student is able to analyse the characteristics of real-time distributed systems; is able to acquire an object-oriented, model-based approach to solve the design problems found in real-time systems; is able to detect and derive specific problems facing the real-time software designer, and to suggest design patterns to solve those problems.

Contents:

Introduction 1. Characteristics of real-time systems; 2. Resource management; 3. Safety and reliability; 4. Time constraints; 5. Concurrency; 6.
Scheduling; 7. Interrupts Characteristics of Distribution 1. Distribution architectures 2. Concept of time; 3.

Synchronisation; 4. Latency and
jitter; 5. Quality of service; 6. Service discovery; 7. Networking primitives Real-Time UML Modelling Methodology Real-Time Design Patterns Design
Examples: Embedded, Ubiquitous, Mobile, Web/Internet.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h, design exercises 15 h, student project 80 h.

Target group:

MSc students

Prerequisites and co-requisites:

Computer architecture, object-oriented analysis and design (UML), programming language C and/or Java.

Recommended or required reading:

Lecture notes. Course book: Douglass B.P. (2009) Real-Time Design Patterns – Robust Scalable Architecture for Real-Time Systems. Addison-
Wesley ISBN 0-201-69956-7. 500 p.

Assessment methods and criteria:

Exam and project evaluation

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Petri Pulli

Working life cooperation:

One or two industrial guest lecturers

817603S: System Design Methods for Information Systems, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Pasi Karppinen

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 1.

Learning outcomes:

After the course the student understands the complexity of business, organizational, technical, and human aspects that affect ISD and the selection of methods in ISD. The student also understands the defects of traditional waterfall model and how other methods aim to answer to these defects and to other challenges in ISD. In particular, with socio-technical methods (e.g., SSM, ETHICS) and their techniques the student is able to re-plan and develop the sub-systems (automated and non-automated) of organization into a coherent whole and to take into account job satisfaction issues in addition to efficiency demands in ISD and in planning workflows in organization. The student is also able to assess and give arguments which method is suitable for an ISD project in an organization.

Contents:

After the course, the student understands the complexity of business, organizational, technical, and human aspects that affect ISD and the
selection of methods in ISD. The student also understands the defects of traditional waterfall model and how other methods aim to answer to the
defects of it and also answer to other challenges in ISD. In particular, with socio-technical methods (e.g., SSM, ETHICS) and their techniques, students are able to re-plan and develop the sub-systems (automated and non-automated) of organization into a coherent whole and to take into account job satisfaction issues in addition to efficiency demands in ISD and in planning workflows in organization. The student is also able to assess and give arguments on which method is suitable for an ISD project in an organization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 20 h, exercises 18 h, homework 36 h, essay 26 h, examination 34 h

Target group:

MSc students

Prerequisites and co-requisites:

Bachelor studies recommended

Recommended optional programme components:

Recommended or required reading:

Avison, D., Fitzgerald, G. (2006) Information Systems Development, methodologies, techniques & tools. Fourth Edition. London: McGraw-Hill.
Research articles (to be announced during the course implementation).

Assessment methods and criteria:

Exercises, assignments, essay, and examination.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Pasi Karppinen

Working life cooperation:

No

813625S: Information Systems Theory, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Dorina Rajanen

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 periods 1 and 2. It is recommended to complete the course at the 2nd autumn semester.

Learning outcomes:

After completing the course, students will have a good knowledge and understanding of a broad array of research topics and themes within the field of information systems; will have good knowledge and understanding of information systems research and the process by which that research is produced; will have competence in critiquing research articles published in some of the leading academic journals and conference proceedings; will have competence in critical thinking, and analysis and synthesis of academic sources; will have competence in verbally presenting arguments in an academic fashion; will know how to write a literature review on an information systems research topic.

Contents:

Information Systems Research Overview, A contemporary selection of Information Systems research themes.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 24 h, seminars 10 h, individual and group assignments 100 h; or self-study: opening lecture 2 h, assignments 132 h.

Target group:

MSc students

Prerequisites and co-requisites:

Bachelor's degree or similar, Research Methods course. Recommended to take before Master's Thesis.

Recommended optional programme components:

Recommended or required reading:

Lectures and Selection of scientific articles

Assessment methods and criteria:

Accepted assignments

Grading:

Numerical scale 1-5 or fail

Person responsible:

Dorina Rajanen

Working life cooperation:

No

Other information:

Course material can be found at OPTIMA e-learning environment, Urkund is used for course work submissions.

521283S: Big Data Processing and Applications, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ekaterina Gilman

Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

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 fundatmenals, data storage, batch and stream data processing, data analysis, privacy and security, big data use cases.

Mode of delivery:

Face-to-face teaching, 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, the exercises do not require programming skills but they are an advantage.

Recommended optional programme components:

Finishing 521290S Distributed Systems, 521497S Pattern recognition and neural networks, and 521286A Computer Systems is beneficial.

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 exercises, seminar presentations and short reports on a selected topic (group work), and answering two quizzes during the course. To pass the course, it is enough to get 50% of available points for each part. No exam.

Grading:

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

Person responsible:

Ekaterina Gilman

Working life cooperation:

The course includes also invited lectures from industry.

Other information:

-

521493S: Computer Graphics, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiaopeng Hong, Yingyue Xu, Guoying Zhao

Opintokohteen kielet: English

Leikkaavuudet:

521140S	Computer Graphics	5.0 op

ECTS Credits:

7 ECTS credits

Language of instruction:

In English.

Timing:

Spring, period 4.

Learning outcomes:

Upon completion of the course, the student:
1. is able to specify and design 2D graphics algorithms including: line and circle drawing, polygon filling and clipping
2. is able to specify and design 3D computer graphics algorithms including transformations, viewing, hidden surface removal, shading, texture mapping and hierarchical modeling
3. is able to explain the relationship between the 2D and 3D versions of such algorithms
4. possesses the necessary basic skills to use these basic algorithms available in OpenGL

Contents:

The history and evolution of computer graphics; 2D graphics including: line and circle drawing, polygon filling, clipping, and 3D computer graphics algorithms including viewing transformations, shading, texture mapping and hierarchical modeling; graphics API (OpenGL) for implementation.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures 30 h / Self-study and programming assignments 104h.

Target group:

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

Prerequisites and co-requisites:

Programming skills using C++; basic data structures; simple linear algebra. Additionally recommended prerequisite is the completion of the following course prior to enrolling for course unit: 521267A Computer Engineering or 521286A Computer Systems or 521287A Introduction to Computer Systems

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:

1) Textbook: Edward Angel, Dave Shreiner: Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, Addison-Wesley 2015
2) Textbook: Edward Angel: Interactive Computer Graphics, 5th Edition, Addison-Wesley 2008
3) Reference: Peter Shirley, Michael Ashikhmin, Michael Gleicher, et al. : Fundamentals of Computer Graphics, second edition, AK Peters, Ltd. 2005
4) Lecture notes (in English)
5) Materials in the internet (e.g. OpenGL redbook) OpenGL Programming Guide or 'The Red Book': http://unreal.srk.fer.hr/theredbook/ OpenGL Video Tutorial: target=_blank>http://www.videotutorialsrock.com/opengl_tutorial/what_is_opengl/text.php

Assessment methods and criteria:

The assessment of the course is based on the exam (50%) and returned course work (50%).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5, zero stands for fail.

Person responsible:

Guoying Zhao, Xiaopeng Hong, Yingyue Xu

Working life cooperation:

No

Other information:

-

521285S: Affective Computing, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Guoying Zhao
Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

Language of instruction:

English

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:

After completing the course, student
1. is able to explain the emotion theory and modeling

2. is able to implement algorithms for emotion recognition from visual and audio signals or the fusion of multi-modalities

3. has the ideas of wide applications of affective computing

Contents:

The history and evolution of affective computing; psychological study about emotion theory and modeling; emotion recognition from different modalities: facial expression, speech, EEG; crowdsourcing study; synthesis of emotional behaviors; emotion applications.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

The course consists of lectures and exercises. The final grade is based on the points from exam while there are several mandatory exercises.

Target group:

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

Prerequisites and co-requisites:

A prior programming knowledge, possibly the bachelor level mathematical studies and/or some lower level intermediate studies (e.g. computer engineering or artificial intelligence courses). The recommended optional studies include the advanced level studies e.g. the pattern recognition and neural networks and/or computer vision courses.

Recommended optional programme components:

-

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment of the course is based on the exam (100%) with mandatory exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Guoying Zhao, Eero Väyrynen, Xiaohua Huang

Working life cooperation:

-

Other information:

-

A452285: Advanced module/applied computing technology (obligatory), 10 - 40 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521152S: Applied Computing Project II, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

ECTS Credits:

10 ECTS cr

Language of instruction:

English.

Timing:

Autumn and Spring, periods 1-4.

Learning outcomes:

1. has advanced understanding on how to collaboratively design a medium-scale software project,

2. has advanced understanding on how to implement and evaluate a medium-scale software project,

3. is able to extensively document a medium-scale software project,

4. has advanced skills in presenting and pitching a project work, i.e. give a good, concise presentation of the work,

Contents:

Project work that is typically executed in groups of 3-5 students. Note: the project work cannot be done alone.

Mode of delivery:

3-4 lectures to introduce and conclude the course and project works, collaborative project work for a "client" (teaching assistants and/or industry representatives).

Learning activities and teaching methods:

Practical work in project teams. The course is passed with an approved project work. The implementation is fully in English.

Target group:

Computer Science and Engineering MSc students and other Students of the University of Oulu.

Prerequisites and co-requisites:

While no specific courses are not required, programming and design skills are desired.

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:

For additional reading (not mandatory): Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).

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:

Matti Pouke, Denzil Ferreira

Working life cooperation:

No

Other information:

-

A452287: Advanced module/Applied computing economy (obligatory), 10 - 40 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

724206A: Strategic Marketing Management, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Waqar Nadeem

Opintokohteen kielet: English

Leikkaavuudet:

ay724206A Strategic Marketing Management (OPEN UNI) 5.0 op

721412P Product and Market Strategies 5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits/133 hours of work

Language of instruction:

English

Timing:

Period B (3rd year)

Learning outcomes:

After having passed this course, students are able to identify the concepts and tools linked to strategic marketing management. The course improves students' ability to evaluate different market situations among industries and propose solutions to strategic product/market decisions. Furthermore, students are able to explain strategy at different levels; corporation, SBU & functional. Students are able to apply concepts and tools of strategic marketing in global and local context that is, they understand the interdependency of macro- and microenvironments. In addition, students will develop and demonstrate analytical thinking skills by applying different marketing strategies in practice and solving real-life business problems in a case exercise guided by the problem based learning (PBL) method. Students will apply oral and written communication skills appropriate for business situations by working in small groups throughout the course, playing various roles of marketing professional and presenting their case report in written and oral form.

Contents:

Strategic marketing management as a concept and as a process of situation assessment, marketing strategies, strategy formulation, and an implementation plan. Concepts such as customer value, market analysis, branding, marketing communications, and business models will be discussed and applied.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

36 h face-to-face teaching, including group exercises and tutoring sessions, case exercise with both written and verbal part (53 h), case presentations (14 h) and independent reading of the textbooks and related material (20 h). During the course students will work in small groups and meet regularly in order to solve a marketing challenge proposed by the case company (case company is the same for all groups). Problem based learning (PBL) method will be applied and students play different roles to simulate tasks of the real life marketing professionals. Relating to these roles, students will write a learning diary (10 h). In the end of the course students will return a written report as a solution for the marketing challenge and present it to other students.

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier modules (introduction to business studies, business processes and analytical skills)

Recommended optional programme components:

This course is part of "Global perspectives"-module

Recommended or required reading:

Kotler, P., Keller, K., Brady, M., Goodman, M. & Hansen, T. (2009 or newer) Marketing Management and other material named by the lecturer.

Assessment methods and criteria:

The written part of the case exercise will determine 70% and the verbal part 30% of the grade. The assessment of the course unit is based on the learning outcomes of the course unit.

Grading:

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

Person responsible:

Waqar Nadeem and Hannu Torvinen.

Working life cooperation:

Through working with a real-life case throughout the course, the students adopt the expert role, and skills and tools for operating in consultative positions in strategic marketing area. Students get to practice their professional presentation and writing skills; displaying their key resolution to the real-life case problem in a convincing, interesting, and justified way. Students gain personal experience of specialized positions in a goal oriented project team.

Other information:

The number of students is limited.

724201A: Internationalization, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Xiaotian Zhang

Opintokohteen kielet: English

Leikkaavuudet:

ay724201A	Internationalization (OPEN UNI)	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits/133 hours of work

Language of instruction:

English

Timing:

Period A (3rd year)

Learning outcomes:

Upon completion of the course, the students understand the basic concepts of entrepreneurship and are able to apply them in practice. The students have basic knowledge about the internationalization processes and are able to recognize and evaluate different international operation modes. The students recognize the basic aspects of strategic and financial planning in the context of SME internationalization. The students are familiar with the culture differences in business context. The students are able to analyze business cases from the perspective of different foreign operation modes.

Contents:

The course consists of two modules - entrepreneurship and international business operations – introducing the basics of entrepreneurship and international business operation modes. The contents cover the concepts of business opportunity and business model, selling and pitching; exporting and importing, contractual and investment entry modes, e-business as a mode of international operation, and the role of venture capital in internationalization of SMEs. Content structure: Introduction and Instructions; Business opportunity and business model; Selling and Pitching; International Operation Modes; Internationalization Process; Venture Capital in Internationalization; Strategic Development in Internationalization; Cultural Differences and International Mindset; Summary.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

30 h lectures and case studies, 6h workshops and presentations, reflection (14 h), reading the course literature (40 h), preparing for the exam (40 h) and home-exam (3 h).

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier modules (introduction to business studies, business processes and analytical skills)

Recommended optional programme components:

This course is part of “Global perspectives”-module

Recommended or required reading:

Welch, L, Benito, G & S Petersen, B. (2007). Foreign Operation Methods. Theory, analysis, strategy. Cheltenham, UK. Edward Elgar Publishing Ltd. Additional material will be assigned during the lectures.

Assessment methods and criteria:

Reflective learning diary, workshops, examination.

Grading:

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

Person responsible:

Xiaotian Zhang and Irina Atkova.

Working life cooperation:

Substance: learning the basic rules of business planning and international operations.
Skills: critical thinking, communication and presentation skills, information search and critical evaluation

Other information:

The number of students is limited. Students are advised to familiarize themselves with the course’s main literature source (Welch et al. 2007) before the beginning of the course.

A452288: Advanced module/Applied computing economy (optional), 20 - 40 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, Choose from the following 35 ECTS cr. Studies that have been completed in the other land can be placed here.

806118P: Introduction to Statistics, 5 op

Voimassaolo: 01.06.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Jari Päkkilä

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay806118P	Introduction to Statistics (OPEN UNI)	5.0 op
806113P	Introduction to Statistics A	5.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish

Timing:

3rd period

Learning outcomes:

After completing the course, student will be able to
- consider issues influencing to data collection
- describe data by appropriate methods (tables, statistics and graphical presentations)
- evaluate the effect size of the sample to the margin of error for instance in Gallup polls and in different market researches
- interpret output of a statistical software.

Contents:

- collecting data, e.g. sampling
- variables and measuring
- descriptive statistical methods and their selection
- margin of error of estimator for population mean and proportion
- statistical literacy
- basic analysis of data using statistical software

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Total 50 h face-to-face teaching including lectures and exercise (partly computer exercises). Independent work 83 h.

Target group:

Minor students

Recommended optional programme components:

After the course, student is able to continue other statistics courses.

Recommended or required reading:

Lecture notes

Assessment methods and criteria:

Mid-term exams and/or final exam and possible homework.

Grading:

Fail, 1-5

Person responsible:

Jari Päkkilä

Working life cooperation:

No

Other information:

-

806119P: A Second Course in Statistics, 5 op

Voimassaolo: 01.06.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Jari Päkkilä

Opintokohteen kielet: Finnish

Leikkaavuudet:

806113P	Introduction to Statistics A	5.0 op
806109P	Basic Methods in Statistics I	9.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish

Timing:

4th period

Learning outcomes:

Upon completion of the course, student will be able to
- analyze continuous and categorical response in the most common experimental and observational studies
- critically evaluate scientific articles
- implement and interpret analyses of a statistical software concerning issues of the course.

Contents:

- Skills for performing statistical analyses and inferences on the basis of data obtained in common experimental and observational studies are expanded and deepened
- statistical literacy of scientific articles with quantitative methods

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Total 50 h face-to-face teaching including lectures and exercise (partly computer exercises). Independent work 83 h.

Target group:

Minor students

Prerequisites and co-requisites:

The recommended prerequisite prior to enrolling for the course is the completion of the course: 806118P Introduction to Statistics or 806116P Statistics for Economic Sciences.

Recommended optional programme components:

After the course, student is able to continue other statistics courses.

Recommended or required reading:

Lecture notes

Assessment methods and criteria:

Mid-term exams and/or final exam and possible homework.

Grading:

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

Person responsible:

Jari Päkkilä

Working life cooperation:

No

Other information:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
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:

Professor Timo Ojala.

Working life cooperation:

-

555314S: Management Information Systems, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits.

Language of instruction:

English.

Timing:

Periods 3 - 4.

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 as a role of 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 face-to-face teaching. If active participation for the course is not possible, independent learning method is offered including a case study in a student's own work organisation (independent learning method is available only for IEM students).

Learning activities and teaching methods:

Lectures 14 h / learning diary 27 hours / self-study and group work 93 h. 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:

Lecture materials. Other materials will be defined at the beginning of the course.

Assessment methods and criteria:

This course utilises continuous assessment (e.g. a reflective learning diary returned on a weekly basis) and conducting the learning tasks. 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. Hanna Kropsu-Vehkaperä.

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.

724050A: Bachelor's Thesis in Economics and Business Administration, 10 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

10 credits / 267 hour of work

Language of instruction:

Finnish

Timing:

C-D (3rd year)

Learning outcomes:

Upon completion of bachelor thesis, the student is able to independently evaluate, write and comment scientific texts from chosen research field. In addition, S/he is able to synthesize and present findings, both in oral and in written form.

Contents:

The student will get familiar with preliminary material (in optima) before the seminar (during period B). S/he does the pre-task to define the preliminary idea of the research topic. Seminar groups are composed based on these deliverables and future master program of the student. Introductory lectures are organized in the beginning of January. Work in seminar groups starts at the same time. Student prepares one's own research plan and intermediate report according to schedule and agreed seminar procedures. Final report is presented during period D, and then student also act as an opponent for fellow student. Integrated studies are: 1) scientific data acquisition and data bases (organized by University Library, registration in weboodi). 2) In addition, typically course Research Communication in Economics (2 credits) is integrated. In that course skills related to writing and presenting are enhanced.

Mode of delivery:

Seminar group meetings and independent work

Target group:

Major students in economics and business administration

Recommended or required reading:

Material defined by the supervisor

Assessment methods and criteria:

Attendance in seminar group sessions according to course schedule and rules. Written and oral presentation of one´s research. Acting as an opponent to fellow researcher. When the student is aiming at a bachelor degree, a maturity test must be conducted where the knowledge of the research theme and skills in Finnish or Swedish are evaluated. Bachelor's thesis should be written and delivered according to the instructions of the faculty.

Grading:

1–5

Person responsible:

Mari Juntunen (Marketing), Tuija Lämsä (International Business Management), Juha Teirilä (Economics), Mirjam Lehenkari (Finance), Hannele Kantola (Accounting), Satu Nätti (Director of BSc Program)

Working life cooperation:

Capabilities for independent information acquisition, analysis and new knowledge production are focal work life skills for our graduates. In addition, throughout bachelor thesis seminar, student enhances their writing and presentation skills, likewise their capabilities to give constructive feedback.

Other information:

The number of students is limited.

724202A: Managing Multinationals, 5 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Lauri Haapanen
Opintokohteen kielet: English
Leikkaavuudet:

ay724202A	Managing Multinationals (OPEN UNI)	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits/133 hours of work

Language of instruction:

English

Timing:

Period B (3rd year)

Learning outcomes:

Upon completion of the course, the student is able to understand different perspectives on multinational corporations (MNCs) and recognize why MNCs exist, how they compete, and what is their impact on society. The student is able to analyze the role of cross-cultural management in MNCs as well as the differences between global and local context. The student pays attention to the diversified nature of MNCs and understands MNC as a network. The student identifies the ethical issues and the corporate responsibility in MNC.

Contents:

Lectures will include the following themes: 1) MNCs as actors in global economy, 2) Different perspectives to MNCs, 3) Changing MNCs (e.g. joint ventures, alliances, mergers and acquisitions), 4) Headquarter and subsidiary relationships, 5) MNCs as networks, 6) Cross-cultural management in MNCs and 7) MNCs in society.

Learning activities and teaching methods:

The course consist of compulsory lectures and visiting lecturers from industries (32h), headquarters-subsidiary game (4h), preparation for the lectures (9h), group works and exercises based on each course theme (40h), preparation for the exam, and independent study (44h) and home exam (4h).

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier modules (introduction to business studies, business processes and analytical skills)

Recommended optional programme components:

This course is part of “Global perspectives”-module

Recommended or required reading:

Forsgren, Mats (2008). Theories of the Multinational Firm;
Article collection and lecture material provided in the course.

Assessment methods and criteria:

Assessment will be at two stages. The group works conducted related to each theme during the course will determine 50% of the grade and the final home exam 50% of the grade. The assessment of the course unit is based on the learning outcomes of the course unit.

Grading:

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

Person responsible:

Lauri Haapanen and Jan Hermes

Working life cooperation:

This course covers topics that students will face when being employed in multinational enterprise. Themes are illustrated using real-life cases, course also has several visitors from local MNEs providing with an insight how the topics emerge in practice. Headquarters-subsidiary game allows students to learn how decisions are made in MNEs.

Other information:

The number of students is limited.

724203A: Financial Statement Analysis, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Pasi Karjalainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay724203A	Financial Statement Analysis (OPEN UNI)	5.0 op
721180P	Financial Statement Analysis	5.0 op
721180A	Financial Statement Analysis	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits / 133 hours of work

Language of instruction:

Finnish

Timing:

Period D (3rd year)

Learning outcomes:

After this course student knows the content of financial statements and understands the main accounting principles in constructing financial statements. In the course student learns the difference between accrual-based –and cash-based accounting. Student understands different stages of financial statement analysis and recognizes main adjustments of the income statement and balance sheet items. The student can calculate and interpret different financial ratios describing profitability, leverage and liquidity of the firm. After this course the student can calculate and interpret the most commonly used market-based ratios. The student knows the main principles for establishment of cash flow statement, knows the content of the cash flow statements and is able to analyze cash flow based ratios. The student understands how different financial ratios are associated and how this information can be applied in the management decisions. Based on the financial statement information, the student recognizes the main leading signals of the firm's financial distress. During the course we practice basic principles for doing the long- and short-term financial planning. The student is able independently to construct large written financial statement analysis and presentation of the target company.

Contents:

The content of the firm's income statement, balance sheet and cash flow statements, main principles of the financial statement analysis, adjustments of the income statement and balance sheets items, calculation and interpretation of financial ratios, cash flow-based statements, main signals and stages of the firm's bankruptcy, tools for analyzing the connections of the ratios.

Mode of delivery:

Face to face teaching, group work and self-study.

Learning activities and teaching methods:

Lectures 20 h, exercises 16 h, exercises and assignment as a group work 97 h.

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier modules (introduction to business studies, business processes)

Recommended optional programme components:

The course is part of “Analytical skills” -module.

Recommended or required reading:

Salmi Ilari (2012). Mitä tilinpäätös kertoo? Edita Publishing Oy.
Yritystutkimus-neuvottelukunta: Yritystutkimuksen tilinpäätösanalyysi (2005 tai uudempi) Gaudeamus.
Other material provided by the lecturer.

Assessment methods and criteria:

Exercises and assignment.

Grading:

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

Person responsible:

KTT Pasi Karjalainen

Working life cooperation:

The course increases student’s capabilities to analyze the financial situation of the firm based on the financial statement- and other firm-specific information. During the course student learn to use Excel spreadsheet software to implement financial statement analysis and provide skills for group working. The course prepares students in working jobs in which employee should analyze firm’s income statement, balance sheet and cash flow statements.

Other information:

The number of students is limited.

724204A: Management Control, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Sinikka Moilanen

Opintokohteen kielet: English

Leikkaavuudet:

721176A	Management Control	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits/133 hours of work

Language of instruction:

English

Timing:

Period A (3rd year)

Learning outcomes:

Upon completion of the course students can define the basic structure of a management control system. They are thus able to describe the design and development needs of management control systems. They can also identify and discuss viewpoints to be taken into account controlling multinational operations. Students can also apply basic accounting control tools, such as budgets and variance analysis, to simple control problems.

Contents:

Management control system design and development, including ethical concerns of and cultural influences on management control systems. Budgets and standards, variance analysis, profit centre accounting and transfer pricing, performance measurement.

Mode of delivery:

Face-to-face teaching with materials and resources in Optima.

Learning activities and teaching methods:

Face-to-face teaching with integrated lectures and exercises 36 h, self-study 97 h. Lectures and exercises contain small cases and examples for illustrating theoretical concepts. Self-study includes theory-based analysis of case-based home assignments and calculations

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier modules (introduction to business studies, business processes and analytical skills)

Recommended optional programme components:

This course is part of “Global perspectives”-module

Recommended or required reading:

Drury, C.: Management & Cost Accounting 7th Ed. 2008 (Parts 4 & 5, pp. 346-591), Cengage Learning EMEA;
Merchant, K. A. & Van der Stede, W. A.: Management control systems – performance measurement, evaluation and incentives, Prentice-Hall, 2nd Ed. 2007;
other material defined by the responsible teacher;
lecture notes and exercises.

Assessment methods and criteria:

Students complete the course by completing case-based home assignments. The assessment of the course is based on the learning outcomes of the course unit, which means that in the home assignments they need to show both ability to describe theory in writing, and to apply basic control tools by calculations.

Grading:

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

Person responsible:

Lecturer Sinikka Moilanen.

Working life cooperation:

Students learn and rehearse basic calculations on budgeting, variance analysis and return on investment, which are the basic skills for accountants in organizations and relevant to understand for any business graduate. Case-based home assignments develop the students’ ability to apply theoretical concepts in real-life situations in order to develop systems and solve problems.

Other information:

The number of students is limited.

724207A: Financial Decisions, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Mirjam Lehenkari

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay724207A Financial Decisions (OPEN UNI) 5.0 op

ay721178P Fundamentals of Corporate Finance (OPEN UNI) 5.0 op

721178P Principles of Corporate Finance 5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits / 133 hours of work

Language of instruction:

Finnish

Timing:

Period C (2nd year)

Learning outcomes:

The course is an introduction to the theory and practice of capital structure decisions. Upon successful completion of the course, the student will be able to describe the most well-known capital structure theories and to identify factors that affect capital structure decisions in practice.

Contents:

1) short- and long-term financial planning, 2) cost of capital, 3) financial leverage, 4) capital structure theories, 5) capital structure decisions in practice, 6) dividend policy in theory and practice, 7) risk management and firm value

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (36 h), self-study (94 h), exam (3 h)

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier module (introduction to business studies)

Recommended optional programme components:

This course is part of "Business Processes" -module

Recommended or required reading:

Ross, Westerfield & Jordan: Fundamentals of Corporate Finance (4th or later edition) / Corporate Finance Fundamentals, Irwin/McGraw-Hill;
Other material announced during the lectures

Assessment methods and criteria:

Faculty examination

Grading:

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

Person responsible:

Postdoctoral researcher Mirjam Lehenkari

Working life cooperation:

Upon successful completion of the course, the student will be able to apply the tools that financial managers need when making their capital structure and dividend decisions.

Other information:

The number of students is limited.

724208A: Portfolio Theory, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Andrew Conlin

Opintokohteen kielet: English

Leikkaavuudet:

721361P Investments 5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits/133 hours of work

Language of instruction:

English

Timing:

Period C (3rd year)

Learning outcomes:

Upon completion of the course, students will be able to: construct optimal portfolios from a limited number of assets; quantitatively show the beneficial effects of diversification on portfolio expected return and variance; describe the relationship between risk aversion and an investor's optimal complete portfolio; distinguish between active and passive portfolio construction, and form optimal active portfolios; derive, compare, and contrast the CAPM and factor pricing models; define the Efficient Market Hypothesis and discuss its implications for investment policy; outline arguments of Behavioral Finance and discuss examples from the literature

Contents:

This course is an introduction to the fundamentals of modern investment theory. Students will create portfolios from limited numbers of assets, and examine the portfolios' return and risk characteristics. The course will cover the CAPM and factor models of asset pricing. The Efficient Market Hypothesis, along with both supporting and contradictory evidence, will be presented. The course will also introduce theory and evidence of Behavioral Finance.

Mode of delivery:

Learning activities and teaching methods:

Online course. Video lectures, with group assignments, discussions, and project work.

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Studies of modules "Introduction to business studies" and "Business processes".

Recommended optional programme components:

This course is part of "Analytical skills"-module

Recommended or required reading:

Lecture notes and textbook Investments, by Bodie, Kane, & Marcus. Mc-Graw-Hill, 6th (or later) ed.

Assessment methods and criteria:

Assignments 30%, Discussions 30%, Project work 40%.

Grading:

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

Person responsible:

Andrew Conlin.

Working life cooperation:

Portfolio theory is required knowledge for careers in finance such as investment advising, investment analysis, and banking. Managing personal investments and retirement savings is also growing in importance.

Other information:

The number of students is limited.

724209A: Monetary Economics, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Svento, Rauli

Opintokohteen kielet: Finnish

Leikkaavuudet:

721115P	Theory of Money, Banking and Monetary Policy	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits / 133 hours of work

Language of instruction:

Finnish

Timing:

Period A (3rd year)

Learning outcomes:

After the course the students are able to explain the concept of money, the role of money in the economy and the principles according to which the demand and supply of money and the interest rates are determined. The students can describe in a basic level the functioning of financial markets, financial institutions and the central bank. They are also able to compare the objectives, tools and mechanisms of monetary policy to each other, and evaluate the effects of monetary policy actions on money markets and the real economy. Completing the course enables students to understand and scrutinize the practical statements and news about the monetary policy issues and functioning of markets for money given in the public media.

Contents:

Financial systems; the concepts of money and financial markets, determination of interest rates, monetary and financial institutions, supervision of banking, central banks; tools, objectives and mechanisms of monetary policy, the connection between monetary policy and aggregate demand and supply.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

36 hours lectures, and independent reading of the textbooks and other material distributed during the course (94 h). Exam (3 h).

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier modules (introduction to business studies, business processes)

Recommended optional programme components:

This course is part of “Analytical skills” -module

Recommended or required reading:

Mishkin, F.S.: The Economics of Money, Banking and Financial Markets, 10th ed. (2013), Pearson;
Howells, P. & Bain, K.: Economics of money, banking and finance: A European text, 4th ed. (2008), Prentice Hall;
the appropriate parts from both of these;
other material possibly announced during the lectures.

Assessment methods and criteria:

Examination based on the literature and lecture materials**.**

Grading:

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

Person responsible:

Professor Rauli Svento

Working life cooperation:

Students learn relevant facts about the operation of money and financial markets, banking, and the conduct of monetary policy 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.

724210A: Global Economics, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Matti Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

721218A	Principles of International Economics	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits/133 hours of work

Language of instruction:

English

Timing:

Period A (3rd year)

Learning outcomes:

After the course the student is capable of explaining the impact of international trade on the economy. In addition the student can compare different instruments of trade policy and their welfare effects. Furthermore the student understands basic functioning of foreign exchange markets.

Contents:

Topics of the course include the basic concepts of international trade including the more recent literature on imperfect competition and strategic behaviour. In addition the course introduces issues of trade policy and international macroeconomics, particularly foreign exchange markets.

Mode of delivery:

Contact teaching

Learning activities and teaching methods:

36 hours of lectures (including exercises) and 93 hours of independent reading of the textbooks. Mid-term exams or final exam.

Target group:

Major students in economics and business administration

Prerequisites and co-requisites:

Earlier modules (introduction to business studies, business processes and analytical skills)

Recommended optional programme components:

This course is part of “Global perspectives”-module

Recommended or required reading:

Feenstra, R. ja A.M. Taylor (2014): International Economics, 3. painos; other material announced during the lectures.

Assessment methods and criteria:

Lectures and exercises, literature examination.

Grading:

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

Person responsible:

Dr. Marko Korhonen.

Working life cooperation:

The world economy impacts global business in increasingly significant ways. After the course students learn what are the impacts of international trade flows and international finance on the global business.

Other information:

The number of students is limited

724205A: Distribution and Retail Management, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Jari Juga

Opintokohteen kielet: Finnish

Leikkaavuudet:

721428A	Retail Management	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits / 133 hours of work

Language of instruction:

Finnish

Timing:

Period D (2nd year).

Learning outcomes:

Upon completion of this course the student knows the functions, flows and processes in distribution channels and can formulate distribution objectives within the context of current logistics and retail management. The student can assess the business concepts and formats of retail and understands the role of vertical and horizontal coordination in distribution channels. The student can identify dependencies of distribution activities and understands their impacts on competitiveness. The student has an understanding of the economic role and importance of distributive functions in society with a special view of sustainable business and economy.

Contents:

Structural, operational and social factors and models in distribution channels. Logistical activities, channel member roles and functions and retail models (e.g. franchising, cooperatives, e-commerce, multi-channel distribution). Functional inter-dependencies in distribution with illustrative examples.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

36 h lectures, reading the course literature (54 h), assignments (40 h) and exam (3 h).

Target group:

Major students in economics and business administration

Recommended optional programme components:

The course is part of “Analytical skills” -module.

Recommended or required reading:

Kautto, M., Lindblom A. & Mitronen, L.: Kaupan liiketoimintaosaaminen (Talentum, 2008) and other learning material specified during lectures.

Assessment methods and criteria:

Lecture- and literature examination and course assignments.

Grading:

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

Person responsible:

Professor Jari Juga

Working life cooperation:

Visiting experts from trade and industry elaborate on retail and logistics perspectives. Team work is used for practicing analytical skills in retail business management.

Other information:

The number of students is limited.

A452281: Advanced Module/Embedded Systems, Embedded Systems Electronics (obligatory), 16 - 21 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

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 excerices.

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:

Nilsson, Riedel: Electric Circuits (6th or 7th ed., Prentice-Hall 1996), Chapters 12-18.

Assessment methods and criteria:

Course is examined by a final exam. Obligatory 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:

-

521445S: Digital Techniques 3, 6 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Lahti

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

521281S: Application Specific Signal Processors, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Autumn, period 1.

Learning outcomes:

After completing the course, student
1. Can distinguish the main types of signal processors

2. Can design basic customized transport triggered architecture processors

3. Is capable of assembling a signal processor out of basic entities

4. Can match the processor performance and the application requirements

5. Applies the TTA codesign environment and Altera's FPGA tools to synthesize a system

Contents:

Examples of modern signal processing applications, main types of signal processors, parallel signal processing, transport triggered architectures, algorithm-architecture matching, TCE design environment and Altera FPGA tools.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

Lectures 12h (participation mandatory); Instructed labs 12h. Independent work 111h

Target group:

Computer Science and Engineering students + other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those who are specializing into signal processing.

Prerequisites and co-requisites:

521267A Computer Engineering or 521286A Computer Systems (8 ECTS cr) or 521287A Introduction to Computer Systems (5 ECTS cr) and 521337A digital filters, programming 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:

Handouts.

Assessment methods and criteria:

Participation in mandatory classes and approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Teemu Nyländen

Working life cooperation:

No.

Other information:

-

A452282: Advanced Module/Embedded Systems, Embedded Systems Electronics (optional), 14 - 39 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, Choose from the following 39 ECTS cr. Studies that have been completed in the other land can be placed here.

813621S: Research Methods, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

Leikkaavuudet:

521146S	Research Methods in Computer Science	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 periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

Learning outcomes:

Having completed the course, the student is able to explain the general principles of scientific research and the practices of scientific methodology. The student is also able to generate research problems in information processing sciences. The student is able to identify and describe the main research approaches and methods in information processing sciences, and choose the appropriate approach and method for a research problem. The student is also able to evaluate the methodological quality of a research publication. After the course the student is able to choose and apply the proper approach and method for his or her Master’s thesis and find more information on the method from scientific literature.

Contents:

Introduction to general scientific principles, scientific research practices and quality of scientific publications, qualitative research approaches and selected research methods, quantitative research approaches and selected research methods, design science research and selected methods, requirements and examples of Master’s theses, evaluation of research.

Mode of delivery:

Face-to-face teaching, lecture videos

Learning activities and teaching methods:

Lectures 40 h, exercises 30 h and individual work 65 h. Learning diary is written about the lectures and exercises. Exercises include group work.

Target group:

MSc students

Prerequisites and co-requisites:

Completion of Bachelor’s studies

Recommended or required reading:

Lecture slides and specified literature

Assessment methods and criteria:

Accepted learning diary

Grading:

Pass or fail

Person responsible:

Arto Lanamäki

521405A: Electronic System Design, 5 op

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

ECTS Credits:

5

Language of instruction:

English/Finnish.

Timing:

Period 1

Learning outcomes:

1. is able to choose the optimum method of the choices presented in the course in the field of power supply, thermal design, grounding, and routing of the high speed signals.
2. is able to calculate problems, caused by electrical disturbances, crosstalk and non-idealities of electrical components.
3. can calculate reliability of an electrical device or system.
4. The main goal of the course is to introduce methods and techniques needed in designing larger electronic entities such as equipment and systems.

Contents:

Power supplies, thermal design, grounding, transmission of fast signals by using transmission lines, electrical disturbances, crosstalk, non-idealities of electrical components, reliability of electronics.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

The course includes 30 h of lectures and 20 h of exercises.

Target group:

Primarily in electrical engineering students. Other University of Oulu students can complete the course.

Prerequisites and co-requisites:

Both Principles of Electronics Design and Analogue Electronics I must have been accepted.

Recommended optional programme components:

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

Recommended or required reading:

Lecture notes. Ward & Angus: Electronic Product Design, Hall&Hall&McCall: High speed Digital Design, Montrose: EMC and the Printed Circuit Board, Ott: Noise Reduction Techniques. Eric Bogatin: Signal and Power Integrity – Simplified, 2. ed.

Assessment methods and criteria:

The course is passed by means of a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

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

Person responsible:

Kari Määttä

Working life cooperation:

No.

Other information:

-

521323S: Wireless Communications I, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Jari Iinatti
Opintokohteen kielet: English
Leikkaavuudet:

521395S-01 Wireless Communications I, Exam 0.0 op
521395S Wireless Communications I 5.0 op
521320S Wireless Communications I 8.0 op
521320S-01 Intermediate exam or final exam, Wireless Communications 2 0.0 op
521320S-02 Exercise work, Wireless Communications 1 0.0 op

ECTS Credits:

5 ECTS cr / lecture 28 h, exercises 14 h and the compulsory design work with a simulation program (20 h)

Language of instruction:

English

Timing:

Fall, period 2

Learning outcomes:

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 the suitable diversity methods for fading channel and related combining methods
4. can define the basic carrier and symbol synchronization methods and is able to make the performance comparison of them
5. can explain design methods signals for band-limited channels
6. can classify different channel equalizers, and perform the performance analysis

Contents:

Digital modulation methods and their performance in AWGN-channel, radio channel models, performance of digital modulation in fading channel, diversity techniques, channel equalizers in wireless communication channel, carrier and symbol synchronization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h, exercises 14 h 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 EE degree programme)

Prerequisites and co-requisites:

521330A Telecommunication Engineering 521316S Broadband Communications Systems

Recommended optional programme components:

-

Recommended or required reading:

Parts of book: Andrea Goldsmith: Wireless Communications, Cambridge University Press, 2005. Parts of book: J.G. Proakis: Digital Communications, 4th ed, McGraw Hill, 2001.

Assessment methods and criteria:

The course is passed with a final examination and the accepted design work report. In the final grade of the course, the weight for the examination 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

Working life cooperation:

No

Other information:

-

521443S: Electronics Design II, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Häkkinen
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

521088S: Optoelectronics, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Kostamovaara
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Autumn, period 1

Learning outcomes:

1. is able to explain the principles of operation of optical fibres and wavequides

2. is able to explain the principles of operation of semiconductor light sources and photo detectors, and knows the factors affecting their performance

3. is able to outline the circuit-level structures for optical transmitter circuits and photo detector preamplifiers

4. is able to compare their performance in terms of the main performance parameters

Contents:

Wave/particle dualism of optical radiation, optical waveguides and their properties, sources of radiation (LED- and laser structures), photo detectors (PIN- and AP-diodes,SPAD), light source modulation, preamplifiers and their bandwidth/stability/noise analysis.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h and exercises 20 h, may include a seminar.

Target group:

This course is targeted mainly for the students of electrical engineering degree program, but available for other students as well.

Prerequisites and co-requisites:

Principles of semiconductor devices.

Recommended optional programme components:

This course is independent, no other components are recommended simultaneously.

Recommended or required reading:

Lecture notes, S. Kasap: Optoelectronics and Photonics, Principles and Practices, Prentice Hall 2013, 2nd Ed.

Assessment methods and criteria:

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

Grading:

Numerical grading scale 1-5.

Person responsible:

Juha Kostamovaara

Working life cooperation:

Does not apply.

Other information:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
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:

Professor Timo Ojala.

Working life cooperation:

-

521348S: Statistical Signal Processing, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

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 autumn semester of the master studies.

Learning outcomes:

Upon completion the student will

1. understand the key concepts in estimation theory such as the classical and Bayesian framework.

2. masters the most important estimation principles such as minimum variance, maximum likelihood, least squares and minimum mean square error estimators.
3. can derive an estimator for a given criterion and basic data models.
4. can use the methodology of estimation theory to analyze the performance of estimators
5. can choose a proper estimator for a given purpose
6. understands the basics of detection and classification theory: hypothesis testing, receiver operating characteristics (ROC), matched filtering, estimator-correlator

Contents:

Estimation theory, minimum variance unbiased estimator, Cramer-Rao lower bound, linear models, general minimum variance unbiased estimation, best linear unbiased estimators, maximum likelihood estimation, leas squares estimation, Bayesian estimation, linear Bayesian estimation, Kalman filters, statistical decision theory, receiver operating characteristics, hypothesis testing, matched filter, estimator-correlator.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-face-teaching (lectures and exercises) 50h, Matlab simulation exercises in groups 30 h, independent work 50 h.

Target group:

Electrical, communications, computer and system engineering as well as mathematics, physics and computer science students with knowledge of statistics in master or senior undergraduate level.

Prerequisites and co-requisites:

The required prerequisite is the completion of the following courses prior to enrolling for the course: 031080A Signal analysis, 031021P Statistics, 031078P Matrix algebra

Recommended optional programme components:

-

Recommended or required reading:

Parts from books Kay, Steven M. "Fundamentals of statistical signal processing, volume I: estimation theory." (1993), Kay, Steven M. "Fundamentals of statistical signal processing: Detection theory, vol. 2." (1998), Van Trees, Harry L. Detection, estimation, and modulation theory. John Wiley & Sons, 2004.

Assessment methods and criteria:

Continuous evaluation by solving homework problems, successful completion of simulation projects, a final exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero (0) stands for a fail.

Person responsible:

Markku Juntti

Working life cooperation:

-

Other information:

-

521385S: Mobile Telecommunication Systems, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Katz, Marcos Daniel

Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

English

Timing:

Fall, period 2

Learning outcomes:

1. Upon completing the required coursework, the student will be able to determine and fit the values of the main parameters for modern mobile telecommunication systems network planning. The course gives skills to describe mobility management, adaptive resource control and dynamic resource allocation in mobile networks.
The goal of this course is to provide the basic understanding of dimensioning and performance of mobile communications systems. In addition, the current mobile communications system standards as well as the ones being developed are also studied, preparing students to understand the structure, functionality and dimensioning of these systems.

Contents:

Concept and structures of modern mobile communications systems. Basics of radio network planning and capacity. Distributed transmission power control and mobility management. Resource allocation techniques: adaptive resource control, dynamic resource allocation. Cooperative communications. Examples of digital mobile telecommunication systems in practice.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, exercises 16 h and the compulsory laboratory work (16 h)

Target group:

2nd year M.Sc. and WCE students

Prerequisites and co-requisites:

Telecommunication Engineering, Broadband Communications Systems and Wireless Communications I.

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 material will be defined at the beginning of the course.

Assessment methods and criteria:

The course is passed with a final examination and the accepted laboratory work report.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Marcos Katz

Working life cooperation:

-

Other information:

Objective: The goal of this course is to provide the basic understanding of dimensioning and performance of mobile communications systems. In addition, the current mobile communications system standards as well as the ones being developed are also studied, preparing students to understand the structure, functionality and dimensioning of these systems.

521304A: Filters, 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:

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, excercise and design excercise

Learning activities and teaching methods:

30 h lectures, 14 h exercises. A deign 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:

van Valkenburg: Analog Filter Design, 1982, chapters1-14, 18 ja 20 ; or year 2001 edition chapters 1-13.

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:

-

521328A: Simulations and Tools for Telecommunications, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Saarnisaari, Harri Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

521369A Simulations and Tools for Telecommunications 3.0 op

521369A-01 Simulations and Tools for Telecommunications, exam 0.0 op

521369A-02 Simulations and Tools for Telecomm. exercise 0.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Fall, period 2

Learning outcomes:

1. A student recognizes problems and limitations related to simulations.

2. She/he can select a suitable simulation method and knows how to validate the model.

3. Student knows how to generate signals, random numbers and noise.

4. She/he knows how to model fading channels.

5. A student knows how to make Monte-Carlo simulations at the baseband level and can estimate confidence level of simulation results.

6. She/he can explain principles of network level simulations.

7. A student knows basics of one or two fundamental simulation programs

Contents:

Simulation methods, modelling communication systems with simulations, confidence limits of simulation, noise generation and modelling of fading channel. A simple baseband simulation example. Basics of MATLAB and OPNET simulation software (these could vary depending on needs/availability).

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 24 h (including program introductions), and the compulsory assignment with a simulation program (40 h).

Target group:

3rd year bachelor's degree students

Prerequisites and co-requisites:

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:

Lecture notes. Selected parts (informed in the notes) of Michel C. Jeruchim, Philip Balaban, and K. Sam Shanmugan, Simulation of Communication Systems, Modeling Methodology and Techniques, 2nd edition. Plenum Press, 2000. Additional reading: William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation with Wireless Applications, Prentice Hall, 2004.

Assessment methods and criteria:

The course is passed with a final examination and the accepted simulation work report. The final grade is based on exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Harri Saarnisaari

Working life cooperation:

No

Other information:

-

A452283: Advanced Module/Embedded Systems, Embedded Systems Software (obligatory), 10 - 20 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521155S: Computer Security, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Teemu Tokola, Juha Röning

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits

Language of instruction:

English

Timing:

Autumn semester, period I.

Learning outcomes:

Upon completion of this course, students are familiar with key areas of computer security and have practiced practical skills in these areas with assignments.

Contents:

The course covers the essential aspects of computer security and computer security research in theory and through practical examples.

Mode of delivery:

Lectures and practical assignments

Target group:

The course is intended for computer engineering masters students and additionally to any student interested in computer security that has the sufficient technical background to complete the course exercises.

Prerequisites and co-requisites:

As prior knowledge students should have a basic understanding of how computers and operating systems work and basic skills in programming. Examples of suitable courses to cover these fundamentals are Operating Systems 521453A, Introduction to Programming 521141P and Computer Engineering 521267A.

Recommended optional programme components:

The course is an independent entity.

Recommended or required reading:

-

Assessment methods and criteria:

Grading of the course is made based on the course practical assignments.

Grading:

Numerical scale 1-5, with 0 denoting failure to pass.

Person responsible:

Juha Röning, Teemu Tokola

Working life cooperation:

Visiting lectures from computer security –related companies arranged during the course whenever possible.

Other information:

-

521156S: Towards Data Mining, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Tamminen, Heli Koskimäki

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish or English

Timing:

Autumn, period I.

Learning outcomes:

Student can recognize the type of the data before further analysis and the required preprocessing. The concrete learning outcomes are:

1. Student can design and implement the data gathering
2. Student can combine data from different sources
3. Student can normalize and transfor data, and handle missing or incorrect data.
4. Student can ensure the 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:

16h lectures, 16h 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:

Participation in mandatory classes and 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 and Koskimäki Heli

Working life cooperation:

-

Other information:

-

521266S: Distributed Systems, 6 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ojala, Timo Kullervo

Opintokohteen kielet: English

Leikkaavuudet:

521290S	Distributed Systems	5.0 op

Language of instruction:

In English.

Timing:

Spring, periods 4-5.

Learning outcomes:

Upon completing the course the student is able to explain the key principles of distributed systems, apply them in evaluating the major design paradigms used in implementing distributed systems, solve distributed systems related problems, and design and implement a small distributed system.

Contents:

Architectures, processes, com-munication, naming, synchronization, consistency and replication, fault tolerance, security, distributed object-based systems, distributed file systems, distributed web-based systems, distributed coordination-based systems.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

Lectures 30 h, exercises 26 h, project work 50 h, self-study 54 h. Project work is completed as group work.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu.

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:

Required literature: Andrew S. Tanenbaum and Maarten van Steen, Distributed Systems – Principles and Paradigms, Second Edition, Prentice Hall, 2007, ISBN 978-0132392273, 704 pages.

Assessment methods and criteria:

The course uses continuous assessment so that there are 3 intermediate exams. Alternatively, the course can also be passed with a final exam. The course includes a mandatory project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Professor Timo Ojala

Working life cooperation:

None.

521260S: Programmable Web Project, 5 op

Voimassaolo: 01.08.2006 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ivan Sanchez Milara

Opintokohteen kielet: English

Leikkaavuudet:

ay521260S	Programmable Web Project (OPEN UNI)	5.0 op

Status:

The course is mandatory for International Master's Programme in Computer Science and Engineering and Master's Programme in Computer Science and Engineering. It is optional for other degree and master programmes.

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Spring, periods 3-4.

Learning outcomes:

1. Understands the main design concepts related to REST architectural style and ROA architecture

2. Is able to design, test and implement different components of a RESTful Web API

3. Understands what hypermedia is and how can it be used to build RESTful Web APIs

4. Is able to implement simple clients using Web technologies

5. Becomes familiar with basic technologies to store persitent data on the server and serialize data in the Web

Contents:

RESTful Web APIs, hypermedia, transactional/non-transactional databases , RESTful clients (HTML5 and Javascript).

Mode of delivery:

Web-based teaching and face-to-face teaching.

Learning activities and teaching methods:

Lectures 4 h, guided laboratory work 15 h, the rest as self-study and group work. Each group implements programs and writes a report.

Target group:

M.Sc. level students of Computer Science and Engineering; other students of the university of Oulu are accepted if there is enough space in the classes.

Prerequisites and co-requisites:

Elementary programming. Applied Computing Project I is 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:

Mainly course slides and links to different Web resources announced during the first lecture. Course books: * Leonard Richardson, Mike Amundsen & Sam Ruby. RESTful Web APIs. O'Reilly Media 2013. ISBN: 978-1-4493-5806-8. * Leonard Richardson & Sam Ruby,RESTful Web Services. O'Reilly Media 2007. ISBN: 978-0-596-52926-0.

Assessment methods and criteria:

This course unit utilizes continuous assessment. The project work is divided in different deadlines that students must meet to pass the course. Each deadline will be assessed after completion.
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:

Ivan Sanchez Milara

Working life cooperation:

None.

Other information:

This course replaces the course “521260S Representing structured information”.

A452284: Advanced Module/Embedded Systems, Embedded Systems Software (optional), 23 - 35 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, Choose from the following 35 ECTS cr. Studies that have been completed in the other land can be placed here.

813621S: Research Methods, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

Leikkaavuudet:

521146S	Research Methods in Computer Science	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 periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

Learning outcomes:

Having completed the course, the student is able to explain the general principles of scientific research and the practices of scientific methodology. The student is also able to generate research problems in information processing sciences. The student is able to identify and describe the main research approaches and methods in information processing sciences, and choose the appropriate approach and method for a research problem. The student is also able to evaluate the methodological quality of a research publication. After the course the student is able to choose and apply the proper approach and method for his or her Master's thesis and find more information on the method from scientific literature.

Contents:

Introduction to general scientific principles, scientific research practices and quality of scientific publications, qualitative research approaches and selected research methods, quantitative research approaches and selected research methods, design science research and selected methods, requirements and examples of Master's theses, evaluation of research.

Mode of delivery:

Face-to-face teaching, lecture videos

Learning activities and teaching methods:

Lectures 40 h, exercises 30 h and individual work 65 h. Learning diary is written about the lectures and exercises. Exercises include group work.

Target group:

MSc students

Prerequisites and co-requisites:

Completion of Bachelor's studies

Recommended or required reading:

Lecture slides and specified literature

Assessment methods and criteria:

Accepted learning diary

Grading:

Pass or fail

Person responsible:

Arto Lanamäki

812342A: Object Oriented Analysis and Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay812342A	Object Oriented Analysis and Design (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

Finnish. If at least four non-Finnish students take the course, an English exercise group will be organised.

Timing:

The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd autumn semester.

Learning outcomes:

After completing the course, the students know possibilities of UML-language family to describe different views. They can picture a task using Use
cases and scenarios. Moreover they can produce detailed descriptions using activity-, class-, interaction- and state diagrams. They know
principles of object-orientedness and can use abstract as well interface classes. Additionally they can model user interface by state diagrams. They
understand what design patterns are and how they are described and categorised.

Contents:

Principles of object orientation and object-oriented programming; quality criteria of object orientation; design patterns; case use; activity, class, interaction and state machine diagrams; class realisation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures (in Finnish) 30h, exercises and assignments 28h, independent work 85 h

Target group:

Bachelor students.

Prerequisites and co-requisites:

Elementary course of object-oriented programming is a compolsory prerequisite. Basic knowledge of object programming and information systems analysis and design are assumed.

Recommended or required reading:

Bennet, McRobb & Farmer: Object-oriented systems analysis and design, Using UML.

Assessment methods and criteria:

Examination. At least 50% on points needed for passing the course.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Juha Iisakka

812341A: Object-Oriented Programming, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Räsänen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay812341A	Object-oriented Programming (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.

Learning outcomes:

• After completing the course, the student is able to explain the general objectives and techniques of object-oriented programming paradigm. • Furthermore, the student can describe the practical meaning of concepts of object-oriented programming. • The student can construct Java programs that apply inheritance, composition, and polymorphism.

Contents:

Introduction to object-orientation, Basics of programming in Java language, Composition, inheritance and polymorphism, Java collections and exception handling.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 32 h, laboratory exercises 21 h, weekly assignments and independent work 82 h

Target group:

BSc students.

Prerequisites and co-requisites:

Course Introduction to Programming or similar knowledge.

Recommended or required reading:

Timothy Budd: Introduction to object-orientedprogramming, 3rd edition.
Bruce Eckel: Thinkingin Java 3rd edition or later.

Assessment methods and criteria:

Weekly assignments (preferred) or final exam + programming assignment.

Grading:

Numerical scale 1-5 or fail.

Person responsible:

Ilkka Räsänen

521323S: Wireless Communications I, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Jari Iinatti

Opintokohteen kielet: English

Leikkaavuudet:

521395S-01 Wireless Communications I, Exam 0.0 op

521395S Wireless Communications I 5.0 op

521320S Wireless Communications I 8.0 op

521320S-01 Intermediate exam or final exam, Wireless Communications 2 0.0 op

521320S-02 Exercise work, Wireless Communications 1 0.0 op

ECTS Credits:

5 ECTS cr / lecture 28 h, exercises 14 h and the compulsory design work with a simulation program (20 h)

Language of instruction:

English

Timing:

Fall, period 2

Learning outcomes:

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 the suitable diversity methods for fading channel and related combining methods
4. can define the basic carrier and symbol synchronization methods and is able to make the performance comparison of them
5. can explain design methods signals for band-limited channels
6. can classify different channel equalizers, and perform the performance analysis

Contents:

Digital modulation methods and their performance in AWGN-channel, radio channel models, performance of digital modulation in fading channel, diversity techniques, channel equalizers in wireless communication channel, carrier and symbol synchronization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h, exercises 14 h 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 EE degree programme)

Prerequisites and co-requisites:

521330A Telecommunication Engineering 521316S Broadband Communications Systems

Recommended optional programme components:

-

Recommended or required reading:

Parts of book: Andrea Goldsmith: Wireless Communications, Cambridge University Press, 2005. Parts of book: J.G. Proakis: Digital Communications, 4th ed, McGraw Hill, 2001.

Assessment methods and criteria:

The course is passed with a final examination and the accepted design work report. In the final grade of the course, the weight for the examination 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

Working life cooperation:

No

Other information:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-4.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

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:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.

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:

Professor Timo Ojala.

Working life cooperation:

-

521281S: Application Specific Signal Processors, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

ECTS Credits:

5 ECTS cr

Language of instruction:

In English.

Timing:

Autumn, period 1.

Learning outcomes:

After completing the course, student
1. Can distinguish the main types of signal processors

2. Can design basic customized transport triggered architecture processors

3. Is capable of assembling a signal processor out of basic entities

4. Can match the processor performance and the application requirements

5. Applies the TTA codesign environment and Altera's FPGA tools to synthesize a system

Contents:

Examples of modern signal processing applications, main types of signal processors, parallel signal processing, transport triggered architectures, algorithm-architecture matching, TCE design environment and Altera FPGA tools.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

Lectures 12h (participation mandatory); Instructed labs 12h. Independent work 111h

Target group:

Computer Science and Engineering students + other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those who are specializing into signal processing.

Prerequisites and co-requisites:

521267A Computer Engineering or 521286A Computer Systems (8 ECTS cr) or 521287A Introduction to Computer Systems (5 ECTS cr) and 521337A digital filters, programming 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:

Handouts.

Assessment methods and criteria:

Participation in mandatory classes and approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Teemu Nyländen

Working life cooperation:

No.

Other information:

-

521328A: Simulations and Tools for Telecommunications, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Electrical Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Saarnisaari, Harri Tapani
Opintokohteen kielet: Finnish
Leikkaavuudet:

521369A	Simulations and Tools for Telecommunications	3.0 op
521369A-01	Simulations and Tools for Telecommunications, exam	0.0 op
521369A-02	Simulations and Tools for Telecomm. exercise	0.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Fall, period 2

Learning outcomes:

1. A student recognizes problems and limitations related to simulations.

2. She/he can select a suitable simulation method and knows how to validate the model.

3. Student knows how to generate signals, random numbers and noise.

4. She/he knows how to model fading channels.

5. A student knows how to make Monte-Carlo simulations at the baseband level and can estimate confidence level of simulation results.

6. She/he can explain principles of network level simulations.

7. A student knows basics of one or two fundamental simulation programs

Contents:

Simulation methods, modelling communication systems with simulations, confidence limits of simulation, noise generation and modelling of fading channel. A simple baseband simulation example. Basics of MATLAB and OPNET simulation software (these could vary depending on needs/availability).

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 24 h (including program introductions), and the compulsory assignment with a simulation program (40 h).

Target group:

3rd year bachelor's degree students

Prerequisites and co-requisites:

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:

Lecture notes. Selected parts (informed in the notes) of Michel C. Jeruchim, Philip Balaban, and K. Sam Shanmugan, Simulation of Communication Systems, Modeling Methodology and Techniques, 2nd edition. Plenum Press, 2000. Additional reading: William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation with Wireless Applications, Prentice Hall, 2004.

Assessment methods and criteria:

The course is passed with a final examination and the accepted simulation work report. The final grade is based on exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Harri Saarnisaari

Working life cooperation:

No

Other information:

-

521013A: Advanced Practical Training, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Riku Hietaniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

521027S	Advanced practical training	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
3
Language of instruction:
Finnish/English
Timing:
Whole academic year. Periods 1-4.
Learning outcomes:
After the advanced practical training the student can describe one possible future job, or another kind of position in an already familiar working environment. The student can identify problems in the working environment and solve them. The student can apply theoretical knowledge acquired in the studies to practical tasks. The student can identify roles of a diploma-engineer in the work place.
Contents:

Training in the research laboratories, development laboratories and process laboratories, among others, of the industry and institutions in the field of study. The technical goal of practical training is to give a general insight of the field in which the trainee will work after having taken the degree and to support and to promote theoretical studying. Likewise, the training has to acquaint the trainee with the social points of the industrial production and with industrial safety and has to give a sufficient picture of the technical details of the performing of different work. Furthermore, the training gives a general idea of the technical and economic organizing, administration and management of a company and its production.

Mode of delivery:

Independent work.

Learning activities and teaching methods:

Students find their training jobs themselves.

Target group:

Computer Science and Engineering MSc students.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

-

Recommended or required reading:

None.

Assessment methods and criteria:

For the compulsory MSc stage practical training lasting at least two months a training report is required for which an acceptable grade must be obtained. A more exact compilation instruction of the training report is on the WWW pages of the degree programs.

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

Grading:

Pass/fail.

Person responsible:

Riku Hietaniemi

Working life cooperation:

Yes.

521993S: Master's Thesis in Computer Engineering, 30 op

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

30

Language of instruction:

Finnish/English

Timing:

Second year of MSc studies

Learning outcomes:

The student is able to set goals for a given task. He can structure the topic coherently, with emphasis on the key issues. Depending on the nature of the work, the student is able to present the existing results or technological implementations so that the methods used in the work are justified in relation to the state of the art in the field of engineering or science in question. He is able to apply the knowledge and state of the art methods of the subject area in his work. He can present clearly his plan and solution implemented, justify the choices made, and assess the functionality of the solution with relevant testing and evaluation methods. In addition, he is able to compare the results against goals and to consider their general significance to modern engineering or science, and assess the broader significance of the results to the company, organization or project. The student is able to produce smooth, clear and finalized text based on technical and scientific writing practices of the field.

Contents:

The thesis work is carried out independently. The student defines the content of the thesis under the guidance of the supervisor. The degree program committee approves the thesis topic and content.

The thesis is recorded in accordance with the orientation using the following codes:

- 521981S Master's Thesis in Information Processing Engineering, 30 ECTS cr
- 522985S Master's Thesis in Applied Computing, 30 ECTS cr

- 521984S Master's Thesis in Embedded Systems, 30 ECTS cr

Mode of delivery:
Face-to-face meetings with the supervisor and independent studying.
Learning activities and teaching methods:
Independent work under the guidance of the supervisor.
Target group:
Second year MSc students.
Prerequisites and co-requisites:
Compulsory advanced studies preceding the thesis (90 ECTS cr).
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
The thesis is assessed by two reviewers (supervisor and second reviewer) and approved by the degree program committee. Assessment Criteria at the University of Oulu can be found here.
Grading:
1-5 (1=sufficient, 2=satisfactory, 3=good, 4=very good, 5=excellent)
Person responsible:
Supervising professor or researcher
Working life cooperation:
Yes.
Other information:
Detailed instructions: http://www.oulu.fi/cse/studying/masters-thesis

521009S: The Maturity Test for Master`s Degree, 0 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

910003S: , 5 op

Voimassaolo: 01.08.2014 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:
-
Status:
-
Required proficiency level:
-
ECTS Credits:

5 ECTS credits
Language of instruction:
English
Timing:
Fall (Period C)
Learning outcomes:
During the course the students will get familiar with concepts of learning, collaboration, creativity and emotions. They will explore entrepreneurship from the perspective of artistic process, experience and learn the process of artistic creation in teams, experience and analyse emotions; such as uncertainty, frustration, enthusiasm and joy alone and in teams. The students will produce a piece of art as an outcome of the course workshops, and organise and host an art exhibition together.
Contents:
This course employs creative collaborative methods to learn and experience entrepreneurship through art. This process enables outside-of-the-box thinking, creative propositions and getting to know multidisciplinary team members through concrete learning by doing approach. Art is used as an illustration, as materials for case studies, and as a place to work and develop business oriented thinking. The art world is a new metaphor to describe our economy based on innovations and digitalization. The participants will learn a creative mindset and bonding of closer ties in teams.
Mode of delivery:
Participating in the face-to-face sessions and workshops
Learning activities and teaching methods:
Producing a piece of art and presenting it in an exhibition together with others. Reflecting the learning experiences in a personal learning diary during the course. Returning the learning diary latest one week after the course.
Target group:
Open to all
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
Materials provided during the course.
Assessment methods and criteria:
Active participation in the teamwork. Learning diary assessment.
Grading:
Pass or Fail.
Person responsible:
Johanna Bluemink
Working life cooperation:
-
Other information:
The number of students is restricted
Find the Facebook group: "Building Business through Creativity and Collaboration"
https://www.facebook.com/groups/108738746124019/

521012A: Practical Training, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Riku Hietaniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

521019A	Practical training	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
3
Language of instruction:
Finnish.

Timing:
Periods 1-6.
Learning outcomes:
After the practical training the student can describe the job in question and its working environment from the point of view of his or her studies. The student can identify problems in the work and suggest improvements. The student can find connections between work and studies.
Contents:
The training offers students general insight into working life and to support and to support theoretical studying. Likewise the training has to acquaint the trainee with the social points and work safety in the work place.
Mode of delivery:
Independent work.

Learning activities and teaching methods:
The students find their training jobs themselves.
Target group:
Computer Science and Engineering BSc students.
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:
None.
Assessment methods and criteria:
For BSc stage practical training lasting at least two months a training report is required for which an acceptable grade must be obtained. Detailed instructions for training report are available on the WWW pages of the degree program.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.
Person responsible:
Riku Hietaniemi
Working life cooperation:
Yes.
Other information:
Practical training is compulsory in the BSc. Tech degree for students who started in 2010 or earlier. For students starting 2011 or later, practical training (521012A) is optional.

521019A: Practical training, 5 op

Voimassaolo: 01.01.2017 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Riku Hietaniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

521012A	Practical Training	3.0 op

ECTS Credits:
5 ECTS credits
Language of instruction:
Finnish or English
Timing:
This course can be taken in periods I-IV. The recommended time to take this course is during summer of the second year.
Learning outcomes:
Student can apply knowledge and skills learned during university studies to complete work assignments in his/her own field.
Student can evaluate and develop himself/herself as a learner and worker.

Student can plan and evaluate his/her time management and working methods.
Student is capable of working in systematic and goal-oriented manner in group as well as independently.
Student can name important factors that direct the actions of work community and the employer.
Student can name duties where he/she can work after graduating from university.

Contents:

Planning and preparation, introduction to work assignments related to students field of study, carrying out work assignments, documentation of own accomplishments, writing report and reflection.

Mode of delivery:

Independendt work.

Learning activities and teaching methods:

Student independendtly finds a place to work to complete the course. To pass the course, minimum of two months of full time work is required. Work can also be carried out in multiple periods. The required elements are a) Making a practice plan for the working period 4 h, b) Documentation of progress during working 20 h, c) Learning while working 108 h, d) Final raport and reflection 8 h.

Target group:

Bachelor level students in computer science and engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

The course does not require additional studies carried out at the same time. While carrying out the course working assigments are compared to already completed studies.

Recommended or required reading:

No required material.

Assessment methods and criteria:

Course is carried out by working minimum of two months in a work accepted by study program responsible person. Before starting the actual work the student needs to make a plan for the working period and return it to the responsible person. A weekly report is required from every working week. These reports have to turned in before the working period ends. After the working period is over the student writes a final report and returns it to the responsible person. Signed testimonial from the employer is also required with the final report.

Grading:

The course is graded as ”pass/fail”.
Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Riku Hietaniemi

Working life cooperation:

Opintojakso suoritetaan työharjoitteluna.

Other information:

The BSc in Computer science and engineering degree can include optional practical training. This course is alternative to 521012A Practical Training, 3 ECTS.