Opasraportti

Master's Programme in Biomedical Engineering, MSc (Tech) and MHSc, 2019-20 (2019 - 2020)

Master's Programme in Biomedical Engineering 2019-2021

The Master's Programme in Biomedical Engineering (BME) is a joint program organized by two faculties, Faculty of Information Technology and Electrical engineering (ITEE) and Faculty of Medicine (FMED). Studies include compulsory courses for all BME students, compulsory specialization studies based on the faculty (ITEE or FMED), and optional studies. The student executes compulsory studies 70-72 ECTS credits including master´s thesis 30 ECTS and maturity test, studies of the selected specialization module 25 ECTS credits, and optional studies so that the total extent of the degree is a minimum of 120 ECTS credits. Studies are executed according to the personal study plan with individual timetable depending on the optional studies. Some of the courses are held only every second year.

Compulsory Studies 70-72 ECTS Credits

These are compulsory for all students of the BME Master's Programme. Studies include compulsory Master's thesis and Maturity test. Survival Finnish Course (2 ECTS credits) is mandatory for those who are not native Finnish speaking persons nor executed corresponding compensatory course earlier. Each student must prepare a personal study plan as a part of orientation.

Studies of the Selected Specialization Module 25 ECTS Credits

Compulsory studies of the selected option, (1) Signal and Image Processing in ITEE, and (2) Biomechanics and Imaging or (3) Health technology in FMED.

Optional Studies 23-25 ECTS Credits

Optional studies will be executed so that the total extent of the degree is at least 120 credits. Optional studies can be chosen from other modules or from other intermediate and advanced studies that support the degree. In the case of optional studies, if necessary, the student must agree with the organizing department for the participation for the course.

Tutkintorakenteet

Biomedical engineering, MHSc, FMED

Tutkintorakenteen tila: published

Lukuvuosi: 2019-20

Lukuvuoden alkamispäivämäärä: 01.08.2019

Supplementary Studies, max 15 ECTS cr when necessary (enintään 15 op)

Possible need for Supplementary Studies (max 15 ECTS cr) will be determined in the beginning of studies when making the Personal Study Plan (PSP) and depending on contents of earlier degree studies. ECTS credits of the Supplementary Studies will not be included in the total number of the ECTS credits of the degree (120 ECTS cr).

Common Compulsory Studies, 70-72 ECTS cr (70 - 72 op)

Common Compulsory Studies for students, who´s target degree is MHSc.

Finnish students will choose the studies under the title "Common Compulsory Studies for Finnish students only" and non-Finnish students - under the title "Common Compulsory Studies for non-Finnish students only".

Common Compulsory Studies for Finnish students only 70 ECTS cr

080925A: Anatomy and Physiology for Biomedical Engineering, 5 op
041201A: Basics in eHealth, 5 op
580202S: Biomedical Engineering Project, 5 op
080928S: Biomedical Engineering Research Methods and Seminar, 5 op
521273S: Biosignal Processing I, 5 op
521242A: Introduction to Biomedical Engineering, 5 op
580213S: Master's Thesis in Biomedical Engineering, 30 op
580211S: Maturity Test, 0 op
580121S: Practical training, 1 - 5 op
521149S: Special Course in Information Technology, 5 - 8 op

Common Compulsory Studies for non-Finnish students only 72 ECTS cr

080925A: Anatomy and Physiology for Biomedical Engineering, 5 op
041201A: Basics in eHealth, 5 op
580202S: Biomedical Engineering Project, 5 op
080928S: Biomedical Engineering Research Methods and Seminar, 5 op
521273S: Biosignal Processing I, 5 op
521242A: Introduction to Biomedical Engineering, 5 op
580213S: Master's Thesis in Biomedical Engineering, 30 op
580211S: Maturity Test, 0 op
580121S: Practical training, 1 - 5 op
521149S: Special Course in Information Technology, 5 - 8 op
900017Y: Survival Finnish, 2 op

Compulsory Studies / BME FMED Specialization Modules (25 op)

Students of Biomedical Engineering with MHSc as target degree will choose one of the compulsory Specialization Modules (25 ECTS cr) below, that is either "Biomechanics and Imaging" or "Health Technology".

Biomechanics and Imaging, 25 ECTS cr

080916S: Biomechanics of Human Movement, 5 op
080921S: Biomedical Ultrasound, 5 op
080920S: Diagnostic Imaging, 5 op
080922S: Microscopy and Spectroscopic Imaging, 5 op
080915S: Tissue Biomechanics, 5 op

Health Technology, 25 ECTS cr

080916S: Biomechanics of Human Movement, 5 op
521093S: Biomedical Instrumentation, 5 op
080927S: Connected Health and mHealth, 5 op
080929S: Health Technology and Multimodal Monitoring, 5 op
521097S: Wireless Measurements, 5 op

Recommended Optional Studies (23 - 25 op)

There are two different modules of Recommended Optional Studies, which have been compiled to complement the chosen Specialization Module ("Biomechanics and Imaging" or "Health Technology"). Optional studies can also be chosen from other modules or intermediate and advanced studies that support the degree.

Recommended Optional Studies (FMED BME) for Specialization Module "Biomechanics and Imaging"

521156S	Towards Data Mining
761652S	NMR Imaging
521240S	Biophotonics and Biomedical Optics
521153S	Deep Learning
080924S	Biomaterials
521289S	Machine Learning
521466S	Machine Vision
521495A	Artificial Intelligence
521093S	Biomedical Instrumentation
080926A	Introduction to Biomedical Imaging Methods
080923S	Physics in Radiation Therapy
080917S 080918S	Project in Biomedical Technology OR Project in Medical Imaging

Recommended Optional Studies (FMED BME) for Specialization Module "Health Technology"

521156S	Towards Data Mining
464104A	Product Innovations
080915S	Tissue Biomechanics
521124S	Sensors and Measuring Techniques
521240S	Biophotonics and Biomedical Optics
521337A	Digital Filters
521289S	Machine Learning
521495A	Artificial Intelligence
521092A	Electronic Measurement Techniques
521282S	Biosignal Prossesing II
521283S	Big Data Processing and Applications
080919S	Project in Health Technology

Master's Programme in Biomedical Engineering, MSci (TECH)

Tutkintorakenteen tila: published

Lukuvuosi: 2019-20

Lukuvuoden alkamispäivämäärä: 01.08.2019

Supplementary Studies, max 15 ECTS cr when necessary (enintään 15 op)

Possible need for Supplementary Studies (max 15 ECTS cr) will be determined in the beginning of studies when making the Personal Study Plan (PSP) and depending on contents of earlier degree studies. ECTS credits of the Supplementary Studies will not be included in the total number of the ECTS credits of the degree (120 ECTS cr).

Common Compulsory Studies 70-72 ECTS cr (70 - 72 op)

Common Compulsory Studies for students, who´s target degree is Master of Science (Technology).

Finnish students will choose the studies under the title "Common Compulsory Studies for Finnish students only" and non-Finnish students - under the title "Common Compulsory Studies for non-Finnish students only".

Common Compulsory Studies for Finnish students only 70 ECTS cr

521027S: Advanced practical training, 5 op
080925A: Anatomy and Physiology for Biomedical Engineering, 5 op
041201A: Basics in eHealth, 5 op
521284S: Biomedical Engineering Project, 5 op
080928S: Biomedical Engineering Research Methods and Seminar, 5 op
521273S: Biosignal Processing I, 5 op
521009S: Computer Science and Engineering, The Maturity Test for Master`s Degree, 0 op
521467A: Digital Image Processing, 5 op
521242A: Introduction to Biomedical Engineering, 5 op
522987S: Master's Thesis in Biomedical Engineering, 30 op

Common Compulsory Studies for non-Finnish students only 72 ECTS cr

521027S: Advanced practical training, 5 op
080925A: Anatomy and Physiology for Biomedical Engineering, 5 op
041201A: Basics in eHealth, 5 op
521284S: Biomedical Engineering Project, 5 op
080928S: Biomedical Engineering Research Methods and Seminar, 5 op
521273S: Biosignal Processing I, 5 op
521009S: Computer Science and Engineering, The Maturity Test for Master`s Degree, 0 op
521242A: Introduction to Biomedical Engineering, 5 op
522987S: Master's Thesis in Biomedical Engineering, 30 op
521149S: Special Course in Information Technology, 5 - 8 op
900017Y: Survival Finnish, 2 op

Compulsory Studies ITEE BME (Signal and Imaging Processing) 25 ECTS cr (vähintään 25 op)

Please note that in this course list there is a course with code 521149S. Kindly note that under this same code in the WebOodi there are several different course names and ways of execution. In this connection the students are required to complete the course whit the name Function and Analysis of Cardiovascular System.

In addition, please, note that a course 521149S must be completed with 5 ECTS cr.

521285S: Affective Computing, 5 op
521282S: Biosignal Processing II, 5 op

521289S: Machine Learning, 5 op
521466S: Machine Vision, 5 op
521149S: Special Course in Information Technology, 5 - 8 op

Recommended Optional Studies ITEE BME (Signal and Image Processing) 23-25 ECTS cr (vähintään 23 op)

Optional studies will be executed so that the total extent of the degree is at least 120 credits. Optional studies can be chosen from other modules or from other intermediate and advanced studies that support the degree. In the case of optional studies, if necessary, the student must agree with the organizing department for the participation for the course.

Recommended Optional Studies ITEE BME (Signal and Image Processing) 23-25 ECTS cr:

521156S	Towards Data Mining	5
031025A	Introduction to Optimization	5
521348S	Statistical Signal Processing	5
521153S	Deep Learning *	5
521279S	Signal Processing Systems	5
521161S	Multi-Modal Data Fusion	5
080920S	Diagnostic Imaging	5
521495A	Artificial Intelligence	5
521288S	Multiprocessor Programming	5
080926A	Introduction to Biomedical Imaging Methods	1-3
521093S	Biomedical Instrumentation	5
521493S	Computer Graphics	5
521283S	Big Data Processing and Applications	5

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

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, 135 hours of work

Language of instruction:
English
Timing:
Master studies, spring term 2020, 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 acquaints 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
Defense reactions of the body
Respiration
Digestion
Urine secretion
Metabolic regulation, heat regulation
Reproduction
Sensory functions
Nervous system
Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28h, demonstrations 6h. Independent studying 101h. Final examination.
Target group:
Biomedical engineering and physics students
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. Imaging methods are more closely studies in the course 080920S Diagnostic Imaging.
Recommended or required reading:
Students will be informed about the supplementary reading in the beginning of the course.
Assessment methods and criteria:
Mandatory parts of the course: participation in demonstrations, passing the 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.
Course grade is based on score of the final exam
Person responsible:
Professor Miika Nieminen
Working life cooperation:

Demonstrations will be held in hospital environment and are related to diagnostics.
Other information:
Maximum number of participants is 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, 135 hours of work

Language of instruction:
English
(native Finnish speakers are allowed to write their essay in Finnish)
Timing:
The main course for students of the (Master´s) degree programmes is held in the spring semester, 3rd period. This course is meant also for exchange students of the Biomedical Engineering programme
The special edition course is held for exchange students of the Faculty of Medicine (medicine, health sciences) in the autumn semester, 2nd period. Other students can participate in this course depending on availability of free places (limited number of places).
Learning outcomes:
Upon completion of the course:
The student can define central information and communication technology (ICT) terms and solutions in healthcare, and can list respective applications in healthcare services and training.
The student can evaluate the societal and economic significance of information and communication technology in healthcare
The student can understand the position of e-health and telemedicine solutions as a part of the national health care information system.
The student receives an initial view of future health ICT trends from clinical perspective and possibilities to contribute to these with his/her professional background
Contents:
Terms and concepts
-       societal dimensions
-       delivery of health services
-       electronic patient records
-       data transfer within the health care system
-       data transfer between the health care professionals and the 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 in health care
-       future visions of health care information systems
-       changing current topics in connected health like: Artificial Intelligence, knowledge based medicine, cybersecurity etc according to availability
Mode of delivery:
Web-based teaching
Learning activities and teaching methods:
Interactivity takes place in virtual learning environment Optima or Moodle depending availability during the course. The course consists of videotaped lectures, power point presentations and links to other material available in the web. Performance of duties includes an essay, exam, participating in moderated discussions on the grounds of the lectures.
Web lectures 15h / Web exam 40h / Written essay 40h* / Self-study and participation in 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 & Wellness Technology (medical technology, biomedical engineering, biophysics, physics, other degree programs), students of Medicine and Health Sciences and Information technology and everyone who is interested. Please, note the recommended separate course timings for different groups.
Prerequisites and co-requisites:
None
Recommended optional programme components:
The course is independent and does not require additional studies carried out at the same time.

Recommended or required reading:
All recommended or required reading is offered in the virtual learning environment or in linked web pages.
Assessment methods and criteria:
Web tasks, contribution to moderated discussion, an essay and course exams and optional final exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 0 – 5. In the numerical scale zero stands for a fail.
Person responsible:
Professor Jarmo Reponen
Course teacher Nina Keränen, MD, MSc
Course teacher Anna Maijala MSc

580202S: Biomedical Engineering Project, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Mikko Finnilä

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS cr
Language of instruction:
Finnish / English
Timing:
The course can be taken during Master studies in autumn or spring semester, or during the summer
period. However, it is recommended to be completed during the 2nd autumn semester.
Learning outcomes:
Upon completion of the course, the student will be able to solve a research or development problem and report it in writing and by giving an oral presentation.
Contents:
Performing a small scale research or development project.
Mode of delivery:
Independent work
Learning activities and teaching methods:
The student participates in project within or outside the university. Project topics are available in course folder in virtual learning platform. The student prepares a personal project plan and after the project the student prepares a written research report and presents it in a seminar. Additionally the student participates also in other seminar sessions.
Target group:
Degree students of the Medical and Wellness Technology programme and the Biomedical Engineering programme (primarily BME students of the Faculty of Medicine).
Recommended optional programme components:
The course is an independent entity.
Assessment methods and criteria:
The student prepares a project plan, participates in seminars, and reports project results in written report and in oral presentation.
Read more about assessment criteria at the University of Oulu webpage

Grading:
The course utilizes grading scale pass/fail.
Person responsible:
Post-doctoral Researcher Mikko Finnilä
Working life cooperation:
Project can be commissioned by a company or another organization. Topic and supervision are agreed on together with the client.

080928S: Biomedical Engineering Research Methods and Seminar, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English
Timing:
 Master studies, Autumn term, 1st period
Learning outcomes:
The student familiarizes with the principles of scientific work and research ethics.
The student can identify the essential features of scientific publications.
The student can present the central content of a scientific article to others.
The student can present critical questions related to a scientific presentation, and give and receive feedback on the presentations.
Contents:
Principles of scientific work. Ethical principles. Lectures, seminars and scientific literature. Publication forums in the field and characteristics of scientific articles. Popularization of science.
Mode of delivery:
Face-to-face teaching, remote connection will be offered for lectures and seminars

Learning activities and teaching methods:
Introduction lectures, presentations and discussion on the basis of the latest scientific publications. Each student will give two presentations and act as an opponent for two (peer-assessment).
Lectures 8h, seminars 26h, home exercise, self-study 101h.
Target group:
Biomedical Engineering MSc students
Recommended optional programme components:
The course prepares the student for thesis work.
Recommended or required reading:
Material given during lectures, selected scientific articles.
Assessment methods and criteria:
Attending seminars, making presentations and acting as an opponent. The assessment criteria are based on the learning outcomes of the course. More detailed assessment criteria can be found in e-learning platform.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Grading is made based on student´s presentations.
Person responsible:
Professor Timo Jämsä
Working life cooperation:
The course prepares for working life.

Other information:

Also for doctoral studies

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. The laboratory work can alternatively be performed on an online system.
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.

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 multidisciplinary field of study that ranges from theory to applications at the interface between engineering, medicine and biology. This course will introduce the subdisciplines within biomedical engineering, including such as systems physiology, bioinstrumentation, bioimaging, biophotonics and biomedical signal analysis. General issues of the subdisciplines will be presented together with selected examples and clinical applications. A number of lectures will be given by professionals working in health tech companies, University of Oulu and Oulu University Hospital, presenting different 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. Under some circumstances distance learning using online material is possible (please, ask the teacher).

Learning activities and teaching methods:
The course includes online material, lectures and a group project. Lectures 28h and laboratory exercises 4 h and self-study 100h

Target group:
-
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
Participation in lectures or using the online material and writing a work report.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1 - 5, pass, fail
Person responsible:
Teemu Myllylä
Working life cooperation:
Guest lecturers
Other information:
-

580213S: Master's Thesis in Biomedical Engineering, 30 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:
30 ECTS credits / 810 hours of work
Language of instruction:
Finnish or English
Timing:
Master studies, final year
Learning outcomes:
The student is able to independently describe and solve a research problem on the grounds of learned knowledge and skills. The student is able to report the work in written form according to the scientific reporting principles.
Contents:
Research project in the field of biomedical engineering or medical & wellness technology. Writing of the thesis.

Mode of delivery:
Independent work
Learning activities and teaching methods:
Thesis can be comissioned by a research group of the university or by industry or health care system. The student writes the thesis independently supported by the supervisor. The student should agree in advance on topic, contents and supervision with the responsible professor.
Target group:
Master Students of Medical and Wellness Technology and Biomedical Engineering
Recommended optional programme components:
580211S Maturity Test
Assessment methods and criteria:
Writing the thesis
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:
Thesis can be written in an organization outside the university
Other information:
It is recommended that before starting to write the Master's Thesis the student has completed about 60 ECTS cr of the master studies.

580211S: Maturity Test, 0 op

Voimassaolo: 01.08.2003 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
0 ECTS cr
Language of instruction:
 Finnish / Swedish or English
Timing:
The student takes the Maturity Test in connection with and as a part of the Master´s Thesis.

Learning outcomes:
The student is able to produce intelligible to all paper about his/her field of study and communicate in the language used in the Maturity Test and in this way show his/her command of language and thorough knowledge of the field in question.
Contents:
Content corresponds to the topic of the thesis.

Mode of delivery:
Essay
Learning activities and teaching methods:
The student writes the maturity test in invigilated exam on topic related to his/her thesis
There are instructions for writing a maturity test in the e-learning platform and university´s website
(in Finnish) at http://www.oulu.fi/yliopisto/node/35126
Target group:
Master´s students of Biomedical Engineering and Medical & Wellness Technology
Prerequisites and co-requisites:
The student can take the Maturity Test as soon as he/she has submitted master´s thesis for review and received
permission from the supervisor to register for the test.
Recommended optional programme components:
580213S Master´s Thesis in Biomedical Engineering

Assessment methods and criteria:
The supervisor evaluates and approves contents of the Maturity Test.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass / fail

Person responsible:
 Professor Timo Jämsä

580121S: Practical training, 1 - 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
 1 - 5 ECTS cr, 27 – 135 hours of work
Language of instruction:
Finnish / English
Timing:
The course can be taken in autumn or spring semester, or during the summer period.
Learning outcomes:
Upon completion of the course, the student
-        knows basic skills required in working life,
-        recognizes his/her own skills,
-        is able to present those in the CV.
Contents:
Practical training in the field

Mode of delivery:
Practical training in the field
Learning activities and teaching methods:
The student finds the place for practical training by him/herself and agrees on the training with the person
responsible. 1 ECTS cr equals approximately to two weeks of training. Practical training includes writing a plan before
the training and after the training - updating the CV and evaluation of the learned skills. The student submits the
documents to person responsible for acceptance. The course can be compensated based on earlier working
experience using RPL-protocol (recognition of prior learning).

Target group:
Master´s students of Medical and Wellness Technology and Biomedical Engineering
Prerequisites and co-requisites:
Student needs to have adequate basic skills for the training tasks required by the training place.
Recommended optional programme components:
The course is an independent entity, but the student is expected to have adequate basic skills for learning in the
training.

Assessment methods and criteria:
Before the training period the eligibility of the position is evaluated by the person responsible. Before the training, the student makes a plan for the training and the objectives. After the training period student evaluates skills learned in relation to working skills and studies. Student provides letter of reference and other documentation (CV and form "Application for approval of practical training") for the person responsible. If the student wishes to have the course compensated based on earlier working experience, he/she fills in RPL-form in OSAT system and attaches with the form CV and letter of reference.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes grading scale pass or fail

Person responsible:
Dr Maarit Kangas
Working life cooperation:
Practical training can take place in companies, universities and other research organizations

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

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5-8
Language of instruction:
English
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:
-

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, 135 hours of work

Language of instruction:
English
Timing:
Master studies, spring term 2020, 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 acquaints 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
Defense reactions of the body
Respiration
Digestion
Urine secretion
Metabolic regulation, heat regulation
Reproduction
Sensory functions
Nervous system
Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28h, demonstrations 6h. Independent studying 101h. Final examination.
Target group:
Biomedical engineering and physics students
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. Imaging methods are more closely studies in the course 080920S Diagnostic Imaging.
Recommended or required reading:
Students will be informed about the supplementary reading in the beginning of the course.
Assessment methods and criteria:
Mandatory parts of the course: participation in demonstrations, passing the 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.
Course grade is based on score of the final exam
Person responsible:
Professor Miika Nieminen
Working life cooperation:
Demonstrations will be held in hospital environment and are related to diagnostics.
Other information:
Maximum number of participants is 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, 135 hours of work

Language of instruction:
English
(native Finnish speakers are allowed to write their essay in Finnish)
Timing:
The main course for students of the (Master´s) degree programmes is held in the spring semester, 3rd period. This course is meant also for exchange students of the Biomedical Engineering programme
The special edition course is held for exchange students of the Faculty of Medicine (medicine, health sciences) in the autumn semester, 2nd period. Other students can participate in this course depending on availability of free places (limited number of places).
Learning outcomes:
Upon completion of the course:
The student can define central information and communication technology (ICT) terms and solutions in healthcare, and can list respective applications in healthcare services and training.
The student can evaluate the societal and economic significance of information and communication technology in healthcare
The student can understand the position of e-health and telemedicine solutions as a part of the national health care information system.
The student receives an initial view of future health ICT trends from clinical perspective and possibilities to contribute to these with his/her professional background
Contents:
Terms and concepts
-        societal dimensions
-        delivery of health services
-        electronic patient records
-        data transfer within the health care system
-        data transfer between the health care professionals and the 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 in health care
-        future visions of health care information systems
-        changing current topics in connected health like: Artificial Intelligence, knowledge based medicine, cybersecurity etc according to availability
Mode of delivery:
Web-based teaching
Learning activities and teaching methods:
Interactivity takes place in virtual learning environment Optima or Moodle depending availability during the course. The course consists of videotaped lectures, power point presentations and links to other material available in the web. Performance of duties includes an essay, exam, participating in moderated discussions on the grounds of the lectures.
Web lectures 15h / Web exam 40h / Written essay 40h* / Self-study and participation in 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 & Wellness Technology (medical technology, biomedical engineering, biophysics, physics, other degree programs), students of Medicine and Health Sciences and Information technology and everyone who is interested. Please, note the recommended separate course timings for different groups.
Prerequisites and co-requisites:
None

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

Recommended or required reading:
All recommended or required reading is offered in the virtual learning environment or in linked web pages.
Assessment methods and criteria:
Web tasks, contribution to moderated discussion, an essay and course exams and optional final exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 0 – 5. In the numerical scale zero stands for a fail.
Person responsible:
Professor Jarmo Reponen
Course teacher Nina Keränen, MD, MSc
Course teacher Anna Maijala MSc

580202S: Biomedical Engineering Project, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Mikko Finnilä

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS cr
Language of instruction:
Finnish / English
Timing:
The course can be taken during Master studies in autumn or spring semester, or during the summer
period. However, it is recommended to be completed during the 2nd autumn semester.
Learning outcomes:
Upon completion of the course, the student will be able to solve a research or development
problem and report it in writing and by giving an oral presentation.
Contents:
Performing a small scale research or development project.
Mode of delivery:
Independent work
Learning activities and teaching methods:
The student participates in project within or outside the university. Project topics are available in
course folder in virtual learning platform. The student prepares a personal project plan and after
the project the student prepares a written research report and presents it in a seminar.
Additionally the student participates also in other seminar sessions.
Target group:
Degree students of the Medical and Wellness Technology programme and the Biomedical
Engineering programme (primarily BME students of the Faculty of Medicine).
Recommended optional programme components:
The course is an independent entity.
Assessment methods and criteria:
The student prepares a project plan, participates in seminars, and reports project results in written report and in oral
presentation.
Read more about assessment criteria at the University of Oulu webpage
Grading:
The course utilizes grading scale pass/fail.
Person responsible:
Post-doctoral Researcher Mikko Finnilä
Working life cooperation:
Project can be commissioned by a company or another organization. Topic and supervision are
agreed on together with the client.

080928S: Biomedical Engineering Research Methods and Seminar, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English
Timing:
 Master studies, Autumn term, 1st period
Learning outcomes:
The student familiarizes with the principles of scientific work and research ethics.
The student can identify the essential features of scientific publications.
The student can present the central content of a scientific article to others.
The student can present critical questions related to a scientific presentation, and give and receive feedback on the presentations.
Contents:
Principles of scientific work. Ethical principles. Lectures, seminars and scientific literature. Publication forums in the field and characteristics of scientific articles. Popularization of science.
Mode of delivery:
Face-to-face teaching, remote connection will be offered for lectures and seminars

Learning activities and teaching methods:
Introduction lectures, presentations and discussion on the basis of the latest scientific publications. Each student will give two presentations and act as an opponent for two (peer-assessment).
Lectures 8h, seminars 26h, home exercise, self-study 101h.
Target group:
Biomedical Engineering MSc students
Recommended optional programme components:
The course prepares the student for thesis work.
Recommended or required reading:
Material given during lectures, selected scientific articles.
Assessment methods and criteria:
Attending seminars, making presentations and acting as an opponent. The assessment criteria are based on the learning outcomes of the course. More detailed assessment criteria can be found in e-learning platform.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Grading is made based on student´s presentations.
Person responsible:
Professor Timo Jämsä
Working life cooperation:
The course prepares for working life.

Other information:
Also for doctoral studies

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. The laboratory work can alternatively be performed on an online system.
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.

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 multidisciplinary field of study that ranges from theory to applications at the interface between engineering, medicine and biology. This course will introduce the subdisciplines within biomedical engineering, including such as systems physiology, bioinstrumentation, bioimaging, biophotonics and biomedical signal analysis. General issues of the subdisciplines will be presented together with selected examples and clinical applications. A number of lectures will be given by professionals working in health tech companies, University of Oulu and Oulu University Hospital, presenting different 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. Under some circumstances distance learning using online material is possible (please, ask the teacher).

Learning activities and teaching methods:
The course includes online material, lectures and a group project. Lectures 28h and laboratory exercises 4 h and self-study 100h

Target group:
-
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
Participation in lectures or using the online material and writing a work report.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1 - 5, pass, fail
Person responsible:
Teemu Myllylä
Working life cooperation:
Guest lecturers
Other information:
-

580213S: Master's Thesis in Biomedical Engineering, 30 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Diploma thesis
Vastuuyksikkö: Health Sciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Jämsä, Timo Jaakko
Opintokohteen kielet: English

ECTS Credits:
30 ECTS credits / 810 hours of work
Language of instruction:
Finnish or English
Timing:
Master studies, final year
Learning outcomes:

The student is able to independently describe and solve a research problem on the grounds of learned knowledge and skills. The student is able to report the work in written form according to the scientific reporting principles.
Contents:
Research project in the field of biomedical engineering or medical & wellness technology. Writing of the thesis.

Mode of delivery:
Independent work
Learning activities and teaching methods:
Thesis can be comissioned by a research group of the university or by industry or health care system. The student writes the thesis independently supported by the supervisor. The student should agree in advance on topic, contents and supervision with the responsible professor.
Target group:
Master Students of Medical and Wellness Technology and Biomedical Engineering
Recommended optional programme components:
580211S Maturity Test
Assessment methods and criteria:
Writing the thesis
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:
Thesis can be written in an organization outside the university
Other information:
It is recommended that before starting to write the Master's Thesis the student has completed about 60 ECTS cr of the master studies.

580211S: Maturity Test, 0 op

Voimassaolo: 01.08.2003 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
0 ECTS cr
Language of instruction:
 Finnish / Swedish or English
Timing:
The student takes the Maturity Test in connection with and as a part of the Master´s Thesis.

Learning outcomes:
The student is able to produce intelligible to all paper about his/her field of study and communicate in the language used in the Maturity Test and in this way show his/her command of language and thorough knowledge of the field in question.
Contents:
Content corresponds to the topic of the thesis.
Mode of delivery:
Essay
Learning activities and teaching methods:
The student writes the maturity test in invigilated exam on topic related to his/her thesis
There are instructions for writing a maturity test in the e-learning platform and university´s website (in Finnish) at http://www.oulu.fi/yliopisto/node/35126
Target group:
Master´s students of Biomedical Engineering and Medical & Wellness Technology
Prerequisites and co-requisites:

The student can take the Maturity Test as soon as he/she has submitted master´s thesis for review and received permission from the supervisor to register for the test.
Recommended optional programme components:
580213S Master´s Thesis in Biomedical Engineering

Assessment methods and criteria:
The supervisor evaluates and approves contents of the Maturity Test.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass / fail

Person responsible:
 Professor Timo Jämsä

580121S: Practical training, 1 - 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
 1 - 5 ECTS cr, 27 – 135 hours of work
Language of instruction:
Finnish / English
Timing:
The course can be taken in autumn or spring semester, or during the summer period.
Learning outcomes:
Upon completion of the course, the student
- knows basic skills required in working life,
- recognizes his/her own skills,
- is able to present those in the CV.
Contents:
Practical training in the field

Mode of delivery:
Practical training in the field
Learning activities and teaching methods:
The student finds the place for practical training by him/herself and agrees on the training with the person responsible. 1 ECTS cr equals approximately to two weeks of training. Practical training includes writing a plan before the training and after the training - updating the CV and evaluation of the learned skills. The student submits the documents to person responsible for acceptance. The course can be compensated based on earlier working experience using RPL-protocol (recognition of prior learning).

Target group:
Master´s students of Medical and Wellness Technology and Biomedical Engineering
Prerequisites and co-requisites:
Student needs to have adequate basic skills for the training tasks required by the training place.
Recommended optional programme components:
The course is an independent entity, but the student is expected to have adequate basic skills for learning in the training.
Assessment methods and criteria:
Before the training period the eligibility of the position is evaluated by the person responsible. Before the training, the student makes a plan for the training and the objectives. After the training period student evaluates skills learned in relation to working skills and studies. Student provides letter of reference and other documentation (CV and form "Application for approval of practical training") for the person responsible. If the student wishes to have the course compensated based on earlier working experience, he/she fills in RPL-form in OSAT system and attaches with the form CV and letter of reference.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes grading scale pass or fail

Person responsible:
Dr Maarit Kangas
Working life cooperation:
Practical training can take place in companies, universities and other research organizations

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

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5-8
Language of instruction:
English
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, 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:
Contact teaching, on-line learning and independent work. There will be organized also one on-line group in each semester.
Learning activities and teaching methods:
Lessons 2 times a week (26 h, including the final exam) and guided self study (24 h)
Target group:
International degree and post-graduate degree students 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 on a pass/fail basis.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi.

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

Status:

-

ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English
Timing:
Master´s studies, spring term 4th period
Learning outcomes:
The student can describe the main challenges of movement biomechanics and principles for motion analysis.
The student understands basics of biomechanical measurement and modeling of movement.
The student can perform practical biomechanical experiments, analyze measurement data, interpret results, and report them using good scientific reporting practice.
Contents:
Musculoskeletal biomechanics. Motion sensors and motion analysis. Biomechanical modeling of movement. Balance measurement. Fall biomechanics. Measurement of physical activity.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 14h / assignment and group work 54 h /self-study 67h. Final exam.

Target group:
Master´s students of Biomedical Engineering, medical and wellness technology, information technology and other related degree programs. Master´s students of physics (biomedical physics). Other interested master's and postgraduate students.

Prerequisites and co-requisites:
The student needs to have basic knowledge on statistical analysis, sensors and measurement techniques and signal processing. It is also recommended to have basic knowledge on anatomy and physiology.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. Tissue biomechanics will be studied in the course 080915S.

Recommended or required reading:
Material given during lectures.
Assessment methods and criteria:
Accepted home exercises and lab assignments, exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Grading is made based on the exercise report and exam.

Person responsible:
Professor Timo Jämsä
Working life cooperation:
None

080921S: Biomedical Ultrasound, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikki Nieminen

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credit points / 135 hours of work.
Language of instruction:
English
Timing:
The course is held in the spring semester, during period III (**next time - in spring 2021**). It is recommended to be completed during master studies.
Learning outcomes:
to be updated: Upon completion of the course, the student will be able to:
- Masters the basics of ultrasound physics
- Understands the working principles of methods used in research and clinic
Contents:
to be updated: Ultrasound has enabled establishment of emerging technologies for biomedicine in characterization and therapy. This course focuses ultrasound physics behind these technologies. Research and clinical applications exploiting this physics, such as elastography, quantitative tissue characterization, drug delivery, ultrasound surgery (HIFU), acoustic levitation, tissue actuation and tissue stimulation by ultrasound, will be elaborated.

Mode of delivery:
to be updated: The course is delivered as face-to-face teaching and partially as distance teaching. The course includes independent work.
Learning activities and teaching methods:
to be updated: Lectures 24 h. Excercises 8 h. Independent work 40 h. Project study 30 h with a report and oral presentation 33 h.
Target group:
to be updated: Master students in Biomedical Engineering and Physics, and other interested Master level students.

Prerequisites and co-requisites:
to be updated: Before enrolling for this course the student is required to complete the course 080920S Diagnostic Imaging (5 ECTS cr) or to acquire corresponding information.
Recommended optional programme components:
to be updated: The course and the following courses support each other: 080926A Introduction to Biomedical Imaging Methods 1-3 ECTS credits, and 080922S Microscopy and Spectroscopic Imaging 5 ECTS credits.

Recommended or required reading:
to be updated: Lecture slides and presented literature.
Assessment methods and criteria:
to be updated:
Taking part in lectures, conducting excercises, preparation of the course work (written report + oral presentation).
Read more about assessment criteria at the University of Oulu webpage.
Grading:
to be updated: The course utilizes numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Adjunct Professor Heikki Nieminen
Other information:
This course will be organized next time in spring 2021. Course description will be updated in the curriculum 2020-21.

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, 135 hours of work

Language of instruction:
English
Timing:
Master studies, autumn 2019, 2nd period
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 ultrasound.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 26h, demonstrations 8h, exercises 4h, independent studying and preparing report 97h. Final exam.
Target group:
Students of Biomedical Engineering and Medical and Wellness technology, information technology, master degree students in physics with biophysics as major or/and medical physics as minor, other minor subject students. Also for other students of the University of Oulu.
Prerequisites and co-requisites:
Recommended: basic courses in physics and course Radiation physics, biology and safety (766116P, 761116P, 764117P or 764317A).

Recommended optional programme components:
Other courses of biomedical engineering.
Recommended or required reading:
Dowsett, Kenny, Johnston: The Physics of Diagnostic Imaging, 2nd ed., Hodder Arnold, 2006.
Assessment methods and criteria:
Mandatory parts of the course: Participation in demonstrations, writing a report relating to demonstrations and passing the final exam.
Read more about [assessment criteria](#) at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 1-5 or fail. Course grade is based on score of the final exam.
Possibility to earn additional points from mathematical exercises.
Person responsible:
Professor Miika Nieminen
Working life cooperation:
Demonstrations are held in hospital environment and are related to diagnostics.

080922S: Microscopy and Spectroscopic Imaging, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Lassi Rieppo

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credit points /135 hours of work.

Language of instruction:
English
Timing:
The course is held in the spring semester during period 3. It is recommended to complete the course during Master studies. **The course is organized every second year in uneven years (next time in spring 2021). Current description of the course will be updated by then.**
Learning outcomes:
to be updated: Upon completion of the course, the student can:
- Explain the physical and technical background of conventional optical microscopy, micro-computed tomography, atomic force microscopy, visible light imaging spectroscopy, fourier-transform infrared imaging spectroscopy and Raman imaging spectroscopy
- Understand and describe the concept and differences between grayscale image, RGB image and spectral image
- Perform microscopic and spectroscopic imaging in practice
- Perform basic quantitative analysis for microscopic images
- Perform univariate and multivariate analysis for spectral image data

Contents:
to be updated:
- Introduction to microscopy and spectroscopic imaging
- Quantitative imaging and basic image analysis methods
- Bright field microscopy and digital densitometry
- Polarized light microscopy
- Phase-contrast microscopy, differential interference contrast microscopy, and confocal microscopy
- Micro-computed tomography
- Atomic force microscopy
- Optical imaging spectroscopy, Fourier-transform infrared imaging spectroscopy and Raman imaging spectroscopy
- Univariate and multivariate spectral analysis methods

Mode of delivery:
to be updated: Face-to-face teaching
Learning activities and teaching methods:
to be updated: Lectures 20 h / Exercises 8 h / Demonstrations 6 h, Practical microscopy assignment 15 h / Self-study 86 h. Final exam.
Target group:
to be updated: Master students of Biomedical Engineering (all degree programs) and Physics (biomedical physics major and other minor subject students). The course is also suitable for other interested students with adequate prerequisites.
Prerequisites and co-requisites:
to be updated: Basic knowledge on physics, calculus, differential equations and matrix algebra is required. The ability to use Matlab software is recommended as it will be used in the exercises.
Recommended or required reading:
to be updated: Material given during lectures.
Assessment methods and criteria:
to be updated:
Accepted exercises, assignment and written final exam. The final exam is based on lectures and other given materials, and it includes definition and explanation assignments and problems (including mathematical calculations). Read more about assessment criteria at the University of Oulu webpage.
Grading:
to be updated: The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Dr Lassi Rieppo
Other information:
The course is organized every second year in uneven years (next time in spring 2021). Description of the course will be updated in the curriculum of the academic year 2020-21.

080915S: Tissue Biomechanics, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Simo Saarakkala

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credit points /135 hours of work
Language of instruction:
English
Timing:
The course is held in the autumn semester, during period 2. It is recommended to be completed during Master studies.
Learning outcomes:
The student can describe the main biomechanical characteristics of different tissues as well as their failure mechanisms.
The student can perform practical biomechanical experiments, analyze measurement data, interpret results, and report them using good scientific reporting practice.
The student understands how numerical modeling can be used to solve problems in tissue biomechanics.
Contents:
Introduction to tissue biomechanics. Most important biomechanical parameters and material models. Experimental measurements of biomechanical properties of tissues. Structure, composition and mechanical properties of different tissues. Biomechanical modeling of tissues.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 20h / mathematical exercises 10h / Interactive lecture and group work 4 h / Assignment 8h / Self-study 93h. Final exam.
Target group:
Master students of Biomedical Engineering (all specializations). The course is also suitable for other interested degree and postgraduate students with adequate prerequisites.
Prerequisites and co-requisites:
It is recommended that the student has basic knowledge of cell biology, anatomy and physiology, mechanics, differential equations, and matrix algebra.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. Motion biomechanics will be studied in the course 080916S Biomechanics of Human Movement.
Recommended or required reading:
Material and reading given during the course
Assessment methods and criteria:
Mandatory parts of the course: Accepted assignment with written report and written 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 Simo Saarakkala

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

Status:

-

ECTS Credits:

5 ECTS, 135 hours of work

Language of instruction:

English

Timing:

Master´s studies, spring term 4th period

Learning outcomes:

The student can describe the main challenges of movement biomechanics and principles for motion analysis.

The student understands basics of biomechanical measurement and modeling of movement.

The student can perform practical biomechanical experiments, analyze measurement data, interpret results, and report them using good scientific reporting practice.

Contents:

Musculoskeletal biomechanics. Motion sensors and motion analysis. Biomechanical modeling of movement. Balance measurement. Fall biomechanics. Measurement of physical activity.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 14h / assignment and group work 54 h /self-study 67h. Final exam.

Target group:

Master´s students of Biomedical Engineering, medical and wellness technology, information technology and other related degree programs. Master´s students of physics (biomedical physics). Other interested master's and postgraduate students.

Prerequisites and co-requisites:

The student needs to have basic knowledge on statistical analysis, sensors and measurement techniques and signal processing. It is also recommended to have basic knowledge on anatomy and physiology.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time. Tissue biomechanics will be studied in the course 080915S.

Recommended or required reading:

Material given during lectures.

Assessment methods and criteria:

Accepted home exercises and lab assignments, exam.

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

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Grading is made based on the exercise report and exam.

Person responsible:

Professor Timo Jämsä

Working life cooperation:

None

521093S: Biomedical Instrumentation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Electrical Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Teemu Myllylä

Opintokohteen kielet: Finnish

Leikkaavuudet:

  521107S   Biomedical Instrumentation   6.0 op

ECTS Credits:
5
Language of instruction:
English.
Timing:
Period 4.
Learning outcomes:
After the course the student is capable to explain principles, applications and design of medical instruments most commonly used in hospitals. He/she can describe the electrical safety aspects of medical instruments and can present the physiological 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:
Teemu Myllylä
Working life cooperation:
No.

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, 135 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester period I (1st period)

Learning outcomes:

Upon completion of the course:

-The students will have knowledge about the current overall status of clinical use of health information systems and related tools (e.g. e-Health, telemedicine, Virtual Hospital, ODA-portal and other self-care portals) in Finland

-The students will have knowledge about the state of the art development in mobile health technology solutions and connected health projects.

-The students have been introduced to some practical development examples taking place in OYS Testlab and possibly in other Oulu health test labs

-The students have had an opportunity to consult with some enterprises currently working in the m-Health / Connected health domain.

-Depending on the student composition of the course, the students have learned collaboration in a multiprofessional environment in the medical information and communication technology domain.

Contents:

Terms and concepts

-overview of information and communication technology and information systems in Finnish healthcare

-new processes that activate patient: virtual hospital, self-care models

-current update about mHealth, Connected Health, Artificial Intelligence in health care, secondary use of healthcare information

-collaborative development process in multiprofessional healthcare environment

-introduction to test laboratories

-case example, depending of current R&D&I work at the time of course

-web discussions and possible group assignments

Mode of delivery:

 Blended teaching

Learning activities and teaching methods:

The implementation methods of the course vary. The course will consist of a combination of self-learning materials and activating workshops and other modules. The below mentioned amounts are approximations, because the actual contents will vary according to available development projects:

-virtual learning material in the university virtual learning environment (recorded lectures, examples, additional material) /With self-learning 40 hours of students time

-activating facilitated workshops, where the iterative innovation process is introduced to the students + introductions to the test laboratory environment + Special Key-note lectures either in the virtual environment or as participatory lectures in seminars/With self-learning 40 hours of students time

-Discussions and participation to web tasks /With self-learning 40 h of students time

-Exams and related work/15 h hours of student time

Target group:

Students of the Master´s Programs in Biomedical Engineering and Medical & Wellness Technology. The course will also be available as an elective course for medicine, health sciences, information technology and other interested degree programs.

Prerequisites and co-requisites:

None

Recommended optional programme components:

It is recommended that the student has completed the course 041201A Basics in eHealth.

Recommended or required reading:

Recommended or required reading is offered in Oulu University virtual learning environment or in linked web pages. The teachers can recommend additional material in the beginning of the course.

Assessment methods and criteria:

Web tasks, contribution to moderated discussion and workshops, and course exams.

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

Grading:

The course utilizes a numerical grading scale 1 – 5 or fail.

Person responsible:

Professor Jarmo Reponen (responsible teacher)

Professor Minna Pikkarainen

Course assistant Anna Maijala MSc

Working life cooperation:

The facilitated workshops are meant to be organized in collaboration with OuluHealth TestLabs and enterprises according to availability.

080929S: Health Technology and Multimodal Monitoring, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Teemu Myllylä

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credit points /135 hours of work.
Language of instruction:
English
Timing:
The course is held in the Spring semester, during period III.
Learning outcomes:
The course provides students with a broad overview of the health technology that is currently in development and becoming for home and/or clinical use.
Students learn the concepts of multimodal monitoring and examples of its usage in clinical applications and in medical research (including human and animal studies).
Contents:
Multimodal monitoring is increasingly being employed in clinical monitoring and in
the study of human physiology. It is the simultaneous measurement of multiple physiological parameters to provide better context for their interpretation and correlations, and to enable studies of relationships between different physiological signals. Besides the concepts of multimodal monitoring, this course provides students a broad overview of the health technology that is currently in development and becoming for home or clinical use. Moreover, their usage in medical applications and for different study purposes (human and animal) are dealt.
Mode of delivery:
Web-based teaching + Face-to-face teaching
Learning activities and teaching methods:
Lectures, demonstrations, seminars and self-study
Target group:
Medical and Biomedical students
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Reading material will be provided during the course.
Assessment methods and criteria:
The assessment of the course is based on the learning outcomes of the course, based on the seminar work and exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Adjunct professor Teemu Myllylä
Working life cooperation:
There is no working life cooperation in this course.

521097S: Wireless Measurements, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

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 10 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.

521027S: Advanced practical training, 5 op

Voimassaolo: 01.01.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Riku Hietaniemi

Opintokohteen kielet: Finnish

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 fourth 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, carrying out work assignments in the students field of studies, documentation of own accomplishments, writing report and reflection.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
Student independently 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 course works includes 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:
Master level students.
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"
Person responsible:
Riku Hietaniemi
Working life cooperation:
The course is carried out as practical training.
Other information:
This course is alternative to 521013A Advanced Practical Training, 3 ECTS.

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, 135 hours of work

Language of instruction:
English
Timing:

Master studies, spring term 2020, 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 acquaints 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
Defense reactions of the body
Respiration
Digestion
Urine secretion
Metabolic regulation, heat regulation
Reproduction
Sensory functions
Nervous system

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28h, demonstrations 6h. Independent studying 101h. Final examination.

Target group:
Biomedical engineering and physics students

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. Imaging methods are more closely studies in the course 080920S Diagnostic Imaging.

Recommended or required reading:
Students will be informed about the supplementary reading in the beginning of the course.

Assessment methods and criteria:
Mandatory parts of the course: participation in demonstrations, passing the 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.
Course grade is based on score of the final exam

Person responsible:
Professor Miika Nieminen

Working life cooperation:
Demonstrations will be held in hospital environment and are related to diagnostics.

Other information:
Maximum number of participants is 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, 135 hours of work

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

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

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

Contents:
Terms and concepts
- societal dimensions
- delivery of health services
- electronic patient records
- data transfer within the health care system
- data transfer between the health care professionals and the 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 in health care
- future visions of health care information systems
- changing current topics in connected health like: Artificial Intelligence, knowledge based medicine, cybersecurity etc according to availability

Mode of delivery:
Web-based teaching

Learning activities and teaching methods:
Interactivity takes place in virtual learning environment Optima or Moodle depending availability during the course. The course consists of videotaped lectures, power point presentations and links to other material available in the web. Performance of duties includes an essay, exam, participating in moderated discussions on the grounds of the lectures.
Web lectures 15h / Web exam 40h / Written essay 40h* / Self-study and participation in 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 & Wellness Technology (medical technology, biomedical engineering, biophysics, physics, other degree programs), students of Medicine and Health Sciences and Information technology and everyone who is interested. Please, note the recommended separate course timings for different groups.

Prerequisites and co-requisites:
None

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

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

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

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

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

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

080928S: Biomedical Engineering Research Methods and Seminar, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English
Timing:
 Master studies, Autumn term, 1st period
Learning outcomes:
The student familiarizes with the principles of scientific work and research ethics.
The student can identify the essential features of scientific publications.
The student can present the central content of a scientific article to others.
The student can present critical questions related to a scientific presentation, and give and receive feedback on the presentations.
Contents:
Principles of scientific work. Ethical principles. Lectures, seminars and scientific literature. Publication forums in the field and characteristics of scientific articles. Popularization of science.
Mode of delivery:
Face-to-face teaching, remote connection will be offered for lectures and seminars

Learning activities and teaching methods:
Introduction lectures, presentations and discussion on the basis of the latest scientific publications. Each student will give two presentations and act as an opponent for two (peer-assessment).
Lectures 8h, seminars 26h, home exercise, self-study 101h.
Target group:
Biomedical Engineering MSc students
Recommended optional programme components:
The course prepares the student for thesis work.
Recommended or required reading:
Material given during lectures, selected scientific articles.
Assessment methods and criteria:
Attending seminars, making presentations and acting as an opponent. The assessment criteria are based on the learning outcomes of the course. More detailed assessment criteria can be found in e-learning platform.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Grading is made based on student´s presentations.
Person responsible:
Professor Timo Jämsä
Working life cooperation:
The course prepares for working life.

Other information:
Also for doctoral studies

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. The laboratory work can alternatively be performed on an online system.

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.

521009S: Computer Science and Engineering, 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

ECTS Credits:
0; The maturity test is integrated in the MSc Thesis credits (30 ECTS).

Language of instruction:
Finnish/Swedish/other

Timing:
Periods 1-4

Learning outcomes:
After the maturity test, the student has demonstrated that his/her language skills meet the requirements of the work life.

Contents:
The aim of the maturity test is to confirm the student's familiarity of the thesis area as well as his/her command of the domestic language of his/her school education.

Mode of delivery:
The maturity test is written in a controlled event, on a topic provided by the thesis supervisor.

Learning activities and teaching methods:
Written essay, approximately 3 pages hand written text or 380 words / 3040 characters.

Target group:
-

Prerequisites and co-requisites:
The maturity test can be written when the thesis is complete or being finished.
Recommended optional programme components:
-
Recommended or required reading:
MSc Thesis.
Assessment methods and criteria:
The maturity test is evaluated and approved by the thesis supervisor.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.
Person responsible:
Thesis supervisor.
Working life cooperation:
-

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:
Spring, period 4.
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:
Basic Python programming skills.
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.

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 multidisciplinary field of study that ranges from theory to applications at the interface between engineering, medicine and biology. This course will introduce the subdisciplines within biomedical engineering, including such as systems physiology, bioinstrumentation, bioimaging, biophotonics and biomedical signal analysis. General issues of the subdisciplines will be presented together with selected examples and clinical applications. A number of lectures will be given by professionals working in health tech companies, University of Oulu and Oulu University Hospital, presenting different 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. Under some circumstances distance learning using online material is possible (please, ask the teacher).

Learning activities and teaching methods:
The course includes online material, lectures and a group project. Lectures 28h and laboratory exercises 4 h and self-study 100h

Target group:
-
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
Participation in lectures or using the online material and writing a work report.
Read more about [assessment criteria](#) at the University of Oulu webpage.
Grading:
1 - 5, pass, fail
Person responsible:
Teemu Myllylä
Working life cooperation:
Guest lecturers

Other information:
-

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

521027S: Advanced practical training, 5 op

Voimassaolo: 01.01.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Riku Hietaniemi

Opintokohteen kielet: Finnish

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 fourth 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, carrying out work assignments in the students field of studies, documentation of own accomplishments, writing report and reflection.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
Student independently 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 course works includes 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:
Master level students.
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"
Person responsible:
Riku Hietaniemi
Working life cooperation:
The course is carried out as practical training.
Other information:
This course is alternative to 521013A Advanced Practical Training, 3 ECTS.

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, 135 hours of work

Language of instruction:
English
Timing:
Master studies, spring term 2020, 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 acquaints 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
Defense reactions of the body
Respiration
Digestion
Urine secretion
Metabolic regulation, heat regulation
Reproduction
Sensory functions
Nervous system
Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28h, demonstrations 6h. Independent studying 101h. Final examination.
Target group:
Biomedical engineering and physics students
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time. Imaging methods are more closely studies in the course 080920S Diagnostic Imaging.
Recommended or required reading:
Students will be informed about the supplementary reading in the beginning of the course.
Assessment methods and criteria:
Mandatory parts of the course: participation in demonstrations, passing the 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. Course grade is based on score of the final exam
Person responsible:
Professor Miika Nieminen
Working life cooperation:
Demonstrations will be held in hospital environment and are related to diagnostics.
Other information:
Maximum number of participants is 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, 135 hours of work

Language of instruction:
English
(native Finnish speakers are allowed to write their essay in Finnish)
Timing:
The main course for students of the (Master´s) degree programmes is held in the spring semester, 3rd period. This course is meant also for exchange students of the Biomedical Engineering programme
The special edition course is held for exchange students of the Faculty of Medicine (medicine, health sciences) in the autumn semester, 2nd period. Other students can participate in this course depending on availability of free places (limited number of places).
Learning outcomes:
Upon completion of the course:
The student can define central information and communication technology (ICT) terms and solutions in healthcare, and can list respective applications in healthcare services and training.
The student can evaluate the societal and economic significance of information and communication technology in healthcare
The student can understand the position of e-health and telemedicine solutions as a part of the national health care information system.
The student receives an initial view of future health ICT trends from clinical perspective and possibilities to contribute to these with his/her professional background
Contents:
Terms and concepts
-        societal dimensions
-        delivery of health services
-        electronic patient records
-        data transfer within the health care system
-        data transfer between the health care professionals and the 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 in health care
-        future visions of health care information systems
-        changing current topics in connected health like: Artificial Intelligence, knowledge based medicine,
cybersecurity etc according to availability
Mode of delivery:
Web-based teaching
Learning activities and teaching methods:
Interactivity takes place in virtual learning environment Optima or Moodle depending availability during the course. The course consists of videotaped lectures, power point presentations and links to other material available in the web. Performance of duties includes an essay, exam, participating in moderated discussions on the grounds of the lectures.
Web lectures 15h / Web exam 40h / Written essay 40h* / Self-study and participation in 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 & Wellness Technology (medical technology, biomedical engineering, biophysics, physics, other degree programs), students of Medicine and Health Sciences and Information technology and everyone who is interested. Please, note the recommended separate course timings for different groups.
Prerequisites and co-requisites:
None
Recommended optional programme components:
The course is independent and does not require additional studies carried out at the same time.

Recommended or required reading:
All recommended or required reading is offered in the virtual learning environment or in linked web pages.
Assessment methods and criteria:
Web tasks, contribution to moderated discussion, an essay and course exams and optional final exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 0 – 5. In the numerical scale zero stands for a fail.
Person responsible:
Professor Jarmo Reponen
Course teacher Nina Keränen, MD, MSc
Course teacher Anna Maijala MSc

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

080928S: Biomedical Engineering Research Methods and Seminar, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Health Sciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:
5 ECTS, 135 hours of work

Language of instruction:
English
Timing:
 Master studies, Autumn term, 1st period
Learning outcomes:
The student familiarizes with the principles of scientific work and research ethics.
The student can identify the essential features of scientific publications.
The student can present the central content of a scientific article to others.
The student can present critical questions related to a scientific presentation, and give and receive feedback on the presentations.
Contents:
Principles of scientific work. Ethical principles. Lectures, seminars and scientific literature. Publication forums in the field and characteristics of scientific articles. Popularization of science.
Mode of delivery:
Face-to-face teaching, remote connection will be offered for lectures and seminars

Learning activities and teaching methods:
Introduction lectures, presentations and discussion on the basis of the latest scientific publications. Each student will give two presentations and act as an opponent for two (peer-assessment).
Lectures 8h, seminars 26h, home exercise, self-study 101h.
Target group:
Biomedical Engineering MSc students
Recommended optional programme components:
The course prepares the student for thesis work.
Recommended or required reading:
Material given during lectures, selected scientific articles.
Assessment methods and criteria:
Attending seminars, making presentations and acting as an opponent. The assessment criteria are based on the learning outcomes of the course. More detailed assessment criteria can be found in e-learning platform.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Grading is made based on student´s presentations.
Person responsible:
Professor Timo Jämsä
Working life cooperation:
The course prepares for working life.

Other information:
Also for doctoral studies

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. The laboratory work can alternatively be performed on an online system.
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.

521009S: Computer Science and Engineering, 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

ECTS Credits:
0; The maturity test is integrated in the MSc Thesis credits (30 ECTS).
Language of instruction:
Finnish/Swedish/other
Timing:
Periods 1-4
Learning outcomes:
After the maturity test, the student has demonstrated that his/her language skills meet the requirements of the work life.
Contents:
The aim of the maturity test is to confirm the student's familiarity of the thesis area as well as his/her command of the domestic language of his/her school education.
Mode of delivery:
The maturity test is written in a controlled event, on a topic provided by the thesis supervisor.

Learning activities and teaching methods:
Written essay, approximately 3 pages hand written text or 380 words / 3040 characters.
Target group:
-
Prerequisites and co-requisites:
The maturity test can be written when the thesis is complete or being finished.
Recommended optional programme components:
-
Recommended or required reading:
MSc Thesis.
Assessment methods and criteria:
The maturity test is evaluated and approved by the thesis supervisor.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.
Person responsible:
Thesis supervisor.
Working life cooperation:
-

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 multidisciplinary field of study that ranges from theory to applications at the interface between engineering, medicine and biology. This course will introduce the subdisciplines within biomedical engineering, including such as systems physiology, bioinstrumentation, bioimaging, biophotonics and biomedical signal analysis. General issues of the subdisciplines will be presented together with selected examples and clinical applications. A number of lectures will be given by professionals working in health tech companies, University of Oulu and Oulu University Hospital, presenting different 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. Under some circumstances distance learning using online material is possible (please, ask the teacher).

Learning activities and teaching methods:
The course includes online material, lectures and a group project. Lectures 28h and laboratory exercises 4 h
and self-study 100h

Target group:
-
Prerequisites and co-requisites:
-
Recommended optional programme components:

-
Recommended or required reading:

-
Assessment methods and criteria:
Participation in lectures or using the online material and writing a work report.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1 - 5, pass, fail
Person responsible:
Teemu Myllylä
Working life cooperation:
Guest lecturers
Other information:
-

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

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

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5-8
Language of instruction:
English
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, 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:
Contact teaching, on-line learning and independent work. There will be organized also one on-line group in each semester.
Learning activities and teaching methods:
Lessons 2 times a week (26 h, including the final exam) and guided self study (24 h)
Target group:
International degree and post-graduate degree students 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 on a pass/fail basis.
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 credits
Language of instruction:
In English
Timing:
Fall, periods 1
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, and 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, fusion of multi-modalities; 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 with Python, 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:
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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:
The course unit utilizes a numerical grading scale 1-5, zero stands for fail.
Person responsible:
Guoying Zhao, Henglin Shi, Yante Li
Working life cooperation:
No

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:
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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:
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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 16 h, Laboratory work 16 h, Exercise 16 h and Self-study the rest (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

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:
Upon completion of the course the student
1. understands the fundamentals of image acquisition, representation and modeling
2. can utilize elementary methods of machine vision for image recognition problems
3. can use 2D transformations in model fitting and image registration
4. can explain the basics of 3D imaging and reconstruction

Contents:
1. Introduction, 2. Imaging and image representations, 3. Light and color, 4. Binary image analysis, 5. Texture, 6. Local features, 7. Recognition, 8. Motion, 9. 2D models and transformations, 10. Perceiving 3D from 2D images, 11. 3D transformations and reconstruction.
Mode of delivery:
Face-to-face teaching, homework assignments.

Learning activities and teaching methods:
Lectures (20 h), exercises (16 h) and programming assignments (30 h), self-studying (67 h).
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
521467A Digital Image Processing or an equivalent course, basic Python programming skills.
Recommended optional programme components:
521289S Machine Learning. This course provides complementary knowledge on machine learning methods needed in machine vision.
Recommended or required reading:
Lecture slides and exercise material. The following books are recommended for further information: 1) Shapiro, L.G. & Stockman, G.C.: Computer Vision, Prentice Hall, 2001. 2) Szeliski, R.: Computer Vision: Algorithms and Applications, Springer, 2011. 3) Forsyth, D.A. & Ponce, J.: 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:
Numerical grading scale 1-5. Zero stands for a fail.
Person responsible:
Janne Heikkilä
Working life cooperation:
No.

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

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5-8
Language of instruction:
English
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:
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