Opasraportti

Master's Programme in Biomedical Engineering: Biomechanics and Imaging (2014 - 2015)

Tutkintorakenteet

Master's Programme in Biomedical Engineering: Biomechanics and Imaging

Tutkintorakenteen tila: archived

Lukuvuosi: 2014-15

Lukuvuoden alkamispäivämäärä: 01.08.2014

Language Studies (vähintään 8 op)

900013Y: Beginners' Finnish Course 1, 3 op
900053Y: Beginners' Finnish Course 2, 5 op
900017Y: Survival Finnish Course, 2 op

Choose one of the courses

080917S Project in Biomedical Technology
080918S Project in Medical Imaging
080919S Project in Health Technology

764664S: Analysis and simulation of biosystems, 6 op
580401A: Basic Biomaterials, 2 op
041201A: Basics in eHealth, 5 op
764660S: Bioelectronics, 5 op
080916S: Biomechanics of Human Movement, 5 op
080914S: Biomedical Engineering and Medical Physics Seminar, 3 op
580402S: Biomedical Imaging Methods, 1 - 5 op
521107S: Biomedical Instrumentation, 6 op
521273S: Biosignal Processing I, 5 op
521337A: Digital Filters, 5 op
521467A: Digital Image Processing, 5 op
521124S: Electronic Sensors, 5 op
080902A: Introduction to biomedical engineering, 3 op
764634S: Medical physics and imaging, 5 op
580121A: Practical training, 1 - 5 op
080917S: Project in Biomedical Technology, 5 - 10 op
080919S: Project in Health Technology, 5 - 10 op
080918S: Project in Medical Imaging, 5 - 10 op
080915S: Tissue Biomechanics, 5 op

Master's thesis in Biomedical Engineering (vähintään 30 op)

580213S: Master's Thesis in Biomedical Engineering, 30 op
580211S: Maturity Test, 0 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

900013Y: Beginners' Finnish Course 1, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

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

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

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, the genitive and partitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.
Mode of delivery:
Contact teaching
Learning activities and teaching methods:
Lessons twicea week (24h) and self study (26 h).
Target group:
International degree and post-graduate degree students of the University.
Prerequisites and co-requisites:

Completion of the Survival Finnish Course
Recommended optional programme components:
-
Recommended or required reading:
Gehring, S. & Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)
Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Grading scale is 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi. The course will start right after the Survival Finnish course. The lessons will be held twice a week during a 6-week period.

900053Y: Beginners' Finnish Course 2, 5 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900053Y	Beginners' Finnish Course 2 (OPEN UNI)	4.0 op

Proficiency level:
A1.3
Status:
-
Required proficiency level:
A1.2, completion of the Beginners' Finnish course 1 (900013Y) or the equivalent language skills.
ECTS Credits:
4 ECTS credits
Language of instruction:
As much Finnish as possible; English will be used as a help language.
Timing:
-
Learning outcomes:
By the end of the course the student can understand and use some very common everyday expressions and sentences. S/he can communicate in easy and routine tasks requiring a simple and direct exchange of information on familiar everyday matters. The student understands different kinds of short texts. S/he can for example locate important information in them. In addition, s/he has acquired more detailed knowledge of the language and culture.
Contents:
This is a post-elementary course. During the course students learn more about communication in ordinary everyday situations in Finnish. They also extend their vocabulary and knowledge of grammar. Students practise understanding simple Finnish talk and short texts.

The topics and communicative situations covered in the course are: asking for and giving directions, asking for help /favours, carrying out transactions in shops and restaurants, talking about the past, asking for and expressing opinions and feelings, accommodation, travelling, vehicles, work, professions, food, drink and parties.

The structures studied are: the local cases, nominative plural (basic form plural), imperfect (past tense of verbs), part of the imperative, more declension types for nouns (word types), more about the change of the consonants k, p and t in verbs and nouns, declension of the demonstrative pronouns and personal pronouns, more about the partitive case, basics of the object cases, postpositions and some sentence types in Finnish.
Mode of delivery:
Contact teaching

Learning activities and teaching methods:
Lessons twice a week (50 h) and self study (50 h).
Target group:
International degree and post-graduate degree students of the University.
Prerequisites and co-requisites:
Completion of the Beginners' Finnish Course 1
Recommended optional programme components:
-
Recommended or required reading:
Gehring, S. & Heinzmann, S.: **Suomen mestari 1** (kappaleet 6-9)
Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written midterm and final exams will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Grading scale is 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi. The lessons will be held **twice a week** during a 13-week period.

900017Y: Survival Finnish Course, 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900017Y	Survival Finnish Course (OPEN UNI)	2.0 op

Proficiency level:
A1.1
Status:
-
Required proficiency level:
No previous Finnish studies.
ECTS Credits:
2 ECTS credits
Language of instruction:
Finnish and English
Timing:
-
Learning outcomes:
By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.
Contents:
This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the ‘where'-question.
Mode of delivery:
Multi-modal teaching (Contact teaching, on-line teaching and independent work)
Learning activities and teaching methods:
Lessons twice a week (12 h) and self study (38 h).
Target group:
International degree and post-graduate degree students of the University.
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
Will be provided during the course.
Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Grading scale is 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi. The lessons will be held once a week during a 6-week period.

764664S: Analysis and simulation of biosystems, 6 op

Voimassaolo: 01.01.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

764364A	Analysis and simulation of biosystems	6.0 op

ECTS Credits:
6 credits
Language of instruction:
Finnish (or English)
Timing:
4th spring
Learning outcomes:
The student is able to use modelling in the analysis of simple biosystems, with the utilization of the concept of analogies between different types of systems. Further, with those skills the student will be able to build simulations of relatively simple biosystems and analyze their properties.
Contents:
See 764364A Analysis and simulation of biosystems
Assessment methods and criteria:
Read more about assessment criteria at the University of Oulu webpage.
Person responsible:
Matti Weckström, Iikka Salmela

580401A: Basic Biomaterials, 2 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
2 ECTS
Language of instruction:
Finnish or english
Timing:
Master studies, Autumn. The course is not organized every year.
Learning outcomes:
The student can list essential biological and tissue-replacing materials and can describe their properties. The student identifies and can explain the basics of interactions between biomaterials and tissues.
Contents:
Biocompatibility, metallic and ceramic implantation materials, polymers, biodegradable materials, bioglass, multifunctional biomaterials, tissue engineering, examples of applications.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures (18 h) and written exam.
Target group:
Master Students of Medical and Wellness technology and all other who are intressed in biomaterials.
Recommended or required reading:
Lecture material. Literature: Park JP, Bronzino JD, Biomaterials; Principles and Applications. CRC Press 2002.
Assessment methods and criteria:
Written exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5 or fail.
Person responsible:
Professor Timo Jämsä
Working life cooperation:
No
Other information:
This course is a part of specialization Biomedical Technology.

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
Language of instruction:
English
Timing:
2 nd year autumn
Learning outcomes:
The student can define central information and communication technological terms and solutions in healthcare, and can list respective applications in healthcare services and training.
The student can evaluate the societal and economical significance of information and communication technology in healthcare.
Contents:

- terms and concepts
- societal dimensions
- delivery of health services
- electronic patient records
- data transfer within the health care system
- data transfer between the health care professionals and the patients
- remote consultations, radiologypsychiatry
- economical and functional assessment
- remote education
- future visions of health care information systems
-

Mode of delivery:
Web-based teaching
Learning activities and teaching methods:
Interactivity takes place in virtual learning environment Optima. The course consists of video-taped lectures, power point-presentations and links to other material available in the web. Performance of duties includes an essay, exam, participating in discussions on the grounds of the lectures.
Target group:
Students of Medical Technology (medical and wellness technology, biophysics, other degree programs), Students of Health Sciences and information technology and everyone who is interested.
Recommended or required reading:
All recommended or required reading are offered in Optima virtual learning environment

Assessment methods and criteria:
Web tasks, essay and final exam.
Grading:
1-5
Person responsible:
Professor Jarmo Reponen
Other information:
Recommended literature
Graig J Wootton R, Patterson V (Eds): An introduction to Telemedicine,RSM Press 2006
Saranto K, Korpela M (toim) Tietotekniikka ja tiedonhallinta sosiaali- ja terveydenhuollossa, WSOY, Porvoo-Helsinki-Juva 1999
Hämäläinen P, Reponen J, Winblad I: eHealth of Finland,, Check point 2008, Report 1/2009 Gummerus. Jyväskylä 2009
(http://www.thl.fi/thl-client/pdfs/f5ca5a36-f2c6-4e94-ae95-a7b439b1169b
Winblad I, Reponen J, Hämäläinen P, Kangas M: Informaatio- ja ommunikaatioteknologian käyttö Suomen terveydenhuollossa vuonna 2007. Tilanne ja kehityksen suunta (English summary incl). Stakesin raportteja 37/2008, Stakes, Helsinki 2008
http://www.stakes.fi/verkkojulkaisut/raportit/R37-2008-VERKKO.pdf
Journal of Telemedicine and Telecare
In addition: eLibrary in the Optima comprising updating of the topics of the lectures and some selected essays (by permission of the author)

764660S: Bioelectronics, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
5 credits
Language of instruction:
English
Timing:
4th spring
Learning outcomes:

Students have basic skills for understanding and analyzing of electronics and its applications to measurements of living organisms.
Contents:
The course introduces bioelectric recording techniques, electrodes, most commenly used amplifier types, basic signal processing of biosignals, but also concepts related to the origin of bio-potentials and currents and how they are distributed in biological volume conductors.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 24 h, MatLab-based project work 10 h, calculation exercises 15 h, self-study 84 h
Target group:
Primarily for the students of the degree programme in physics. Also for the other students of the University of Oulu.
Prerequisites and co-requisites:
Physics courses, programming skills.
Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously
Recommended or required reading:
Lectures and lecture notes. Books e.g. Semmlov J, Circuits signals and systems for bioenergetics, Elsevier Academic Press, 2005; Electronic Signal Processing, parts I-IV, The Open University Press, Milton Keynes 1984.
Course material availability can be checked here.
Assessment methods and criteria:
Final exam
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 0 – 5, where 0 = fail
Person responsible:
Matti Weckström
Working life cooperation:
No work placement period
Other information:
https://wiki.oulu.fi/display/764660S/

080916S: Biomechanics of Human Movement, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:
3 ECTS
Language of instruction:
English
Timing:
Master studies, Spring
Learning outcomes:
The student can describe the main challenges of movement biomechanics and principles for motion analysis. The student knows basics of biomechanical measurement and modeling of movement. The student can perform practical biomechanical experiments, analyze measurement data, interpret results, and report them using good scientific reporting practice.
Contents:
Musculoskeletal biomechanics. Motion analysis. Biomechanical modeling of the body. Exercise biomechanics and measurement of physical activity. Biomechanical measurements.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures, exercises, independent work, exam.
Target group:

Students of Medical Technology (medical and wellness technology, biophysics, other degree programs and all other who are interested.
Prerequisites and co-requisites:
761101P Basic Mechanics. Physiology course is recommended.
Recommended or required reading:
Material given during lectures.
Assessment methods and criteria:
Accepted exercises, written exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Professor Timo Jämsä
Working life cooperation:
No
Other information:
This course is a part of the specialization of Health Technology.

080914S: Biomedical Engineering and Medical Physics Seminar, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
3 ECTS
Language of instruction:
Finnish or English
Timing:
Master studies, autumn or spring.
Learning outcomes:
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.
Contents:
Assigned topics are reviewed in seminar meetings.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Seminar presentations and conversations based on the presentations.
Target group:
Students of Medical Technology (medical and wellness technology, biophysics, other degree programs).
Recommended or required reading:
Selected scientific articles.
Assessment methods and criteria:
Attending seminars, making presentations and acting as an opponent.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5.
Person responsible:
Professor Timo Jämsä
Working life cooperation:
No
Other information:
Also for doctoral studies

580402S: Biomedical Imaging Methods, 1 - 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Simo Saarakkala

Opintokohteen kielet: English

ECTS Credits:
1-4 ECTS
Language of instruction:
English
Timing:
Master studies, spring. The course is not organized every year.
Learning outcomes:
The student knows and can describe the basic principles and main applications of imaging techniques used in biomedical research.
Contents:
Differences between in vivo, ex vivo and in vitro imaging. Optical in vivo imaging, optical tomography, magnetic resonance imaging, Fourier transform infrared microspectroscopy, Raman microspectroscopy, micro-computed tomography, basics of image analysis and interpretion.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures, demonstrations, practical exercise. Final exam.
Target group:
Master Students of Medical and Wellness technlogy and all other who are inerest in methods of biomedical imaging.
Recommended or required reading:
Required literature is given in the lectures.
Assessment methods and criteria:
Participation in the lectures and demonstrations, study diary. Exercises. Written exam.
The course can be taken as 1, 2 or 4 ECTS.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass or fail (1 or 2 ECTS), 1-5 (4ECTS).
Person responsible:
Associate Professor Simo Saarakkala
Working life cooperation:
No
Other information:
This course is a part of specialization of Biomedical Technology and Medical imaging.

521107S: Biomedical Instrumentation, 6 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521093S	Biomedical Instrumentation	5.0 op

ECTS Credits:
6
Language of instruction:
English
Timing:
5-6
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 54 h and self-study 100 h.
Target group:
Students interested in biomedical measurements.
Prerequisites and co-requisites:
None
Recommended optional programme components:
Course replaces course 521126S Biomedical measurements
Recommended or required reading:
R. S. Khandpur: Biomedical Instrumentation, Technology and Applications, McGraw-Hill, 2005 and J. G. Webster: Medical Instrumentation, Application and Design, 4th edition, John Wiley & Sons, 2010.
Assessment methods and criteria:
The course is passed by the final exam or optionally with the assignments/test agreed at the first lecture
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Igor Meglinski
Working life cooperation:
None
Other information:
None.

521273S: Biosignal Processing I, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
Lectures are given in Finnish or in English. Laboratory work is given in Finnish and English. The examination can be taken in Finnish or English.
Timing:
Autumn, periods 2 and 3.
Learning outcomes:
After passing the course, student knows special characteristics of the biosignals and typical signal processing methods. Student can solve small-scale problems related to biosignal analysis.

Contents:
Biomedical signals. Digital filtering. Time-domain and frequency-domain analysis, Nonstationarity of biomedical signals. Event detection. Signal characterization.

Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:

Lectures 10 hours (5 times 2 hours) and laboratory work 20 hours (10 times 2 hours), the rest as independent work, written exam.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
The mathematical studies of the BSc of computer science and engineering or equivalent studies, digital filtering, programming skills.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
The course is based on the book "Biomedical Signal Analysis, A Case-Study Approach", R.M Rangayyan. 516 pages. + Lecture transparencies + Task assignment specific material.

Assessment methods and criteria:
Laboratory work is supervised by assistants who 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:
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.

521337A: Digital Filters, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannuksela, Jari Samuli

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay521337A	Digital Filters (OPEN UNI)	5.0 op

ECTS Credits:
5
Language of instruction:
Finnish, English study material available
Timing:
Spring, period 5-6.
Learning outcomes:
Upon completing the required coursework, the student is able to specify and design respective frequency selective FIR and IIR filters using the most common methods. He is also able to solve for the impulse and frequency responses of FIR and IIR filters given as difference equations, transfer functions, or realization diagrams, and can present analyses of the aliasing and imaging effects based on the responses of the filters. Moreover, the student is able to explain the impacts of finite word length in filter design. After the course the student has the necessary basic skills to use signal processing tools available in Matlab environment and to judge the results.

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

Mode of delivery:

Face-to-face teaching (Lectures), independent work, group work
Learning activities and teaching methods:
Lectures and exercises 50 h. The design exercises familiarize the students with the methods of digital signal processing using the Matlab software package. The rest as independent work.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
031018P Complex Analysis, 031050A Signal Analysis
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Lecture notes and exercise materials. Material is in Finnish and in English. Course book: Ifeachor, E., Jervis, B.: Digital Signal Processing, A Practical Approach, Second Edition, Prentice Hall, 2002.

Assessment methods and criteria:
The course can be passed either with week exams or a final exam. In addition, the exercises need to be returned and accepted.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Jari Hannuksela
Working life cooperation:
None.

521467A: Digital Image Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pietikäinen, Matti

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay521467A	Digital Image Processing (OPEN UNI)	5.0 op

ECTS Credits:
5
Language of instruction:
Lectures in Finnish and exercises in English. Course can be passed in Finnish and English.
Timing:
Autumn, periods 1-3.
Learning outcomes:
After completing the course the student understands the basic theory of digital image processing and knows its main applications. He is able to apply spatial and frequency domain and wavelet based methods in image enhancement, restoration, compression, segmentation and recognition.
Contents:
This course provides an introduction to digital image processing and machine vision. Topics: 1.Introduction, 2.Image enhancement, 3.Image restoration,
4. Color image processing, 5. Wavelets, 6. Image compression,7. Morphological image processing, 8. Image segmentation, 9. Representations and descriptions, 10. Pattern recognition.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Lectures 25 h, exercises 7 h and Matlab design exercises 25 h. The rest as independent work.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:

None.
Recommended optional programme components:
In order to obtain deep understanding of the content, it is a benefit if the student has completed the first year mathematic 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, Second Edition, Addison-Wesley, 2002 (see course website: http://www.ee.oulu.fi/research/imag/courses/dkk/). Lecture notes and exercise material.
Assessment methods and criteria:
The course is passed by a final exam and programming exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Matti Pietikäinen
Working life cooperation:
None.

521124S: Electronic Sensors, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Myllylä, Risto Antero, Matti Kinnunen

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
In Finnish. Materials also available in English.

Timing:
Periods 1-2.
Learning outcomes:
After the course the student is capable to explain the operating principles of different sensors and can select a right sensor for each measuring target. He/she is able to quantify the requirements that affect sensor selection as well as recognize and evaluate the uncertainty of a measurement. In addition the student is able to plan and design sensor signal conditioning circuits.
Contents:
Methods for measuring displacement, velocity, acceleration, torque, liquid level, pressure, flow, humidity, sound and temperature. Ultrasound, optical and nuclear measurement techniques and applications, material analyses such as pH measurement and gas concentration, pulp and paper measurements and smart sensors.

Mode of delivery:
Lectures and exercises.
Learning activities and teaching methods:
Lectures and exercises. The course is passed by a final exam.
Target group:
1st year MSc students.
Prerequisites and co-requisites:
Not defined.
Recommended optional programme components:
Not defined.
Recommended or required reading:
H. N. Norton: Handbook of Transducers, Prentice Hall P T R, 1989 or 2002; lecture notes (in Finnish); exercise notes (also in English)
Assessment methods and criteria:
The course is passed by a final exam.

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

1-5
Person responsible:
Matti Kinnunen
Working life cooperation:
None.
Other information:
None.

080902A: Introduction to biomedical engineering, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Seppänen, Weckström, Matti Tapani, Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

764634S: Medical physics and imaging, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
6 credits
Language of instruction:
English
Timing:
4th-5th Autumn
Learning outcomes:
The student is able to define the physical principles on which various medical diagnostic and therapeutic 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, radiation therapy and methods of clinical neurophysiology.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 32 h, calculus assignments 4 h, demonstrations 6 h, reporting 25 h, self-study 112 h
Target group:
Physics MSc students with biophysics major or/and medical physics minor, biomedical engineering students. Also for the other students of the University of Oulu.
Prerequisites and co-requisites:
Recommended: physics basic courses and Radiation physics, biology and safety (761116P, 764117P or 764317A).
Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously
Recommended or required reading:
Dowsett, Kenny, Johnston: The Physics of Diagnostic Imaging, 2nd ed., Hodder Arnold, 2006.
Webster: Medical instrumentation: application and design, 4th ed, John Wiley & Sons, 2010.
Podgorsak: Radiation Oncology Physics – A handbook for teachers and students, IAEA, 2005 (http://www-pub.iaea.org/mtcd/publications/pdf/pub1196_web.pdf).

Additional literature depending on the lecturers.
Course material availability can be checked here.
Assessment methods and criteria:

One written examination
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 0 – 5, where 0 = fail
Person responsible:
Miika Nieminen
Working life cooperation:
No work placement period
Other information:
https://wiki.oulu.fi/display/764634S/

580121A: Practical training, 1 - 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
1-4 ECTS. Practical tarining can be accepted to elective studies. Maximum is 4 ECTS. One ECTS is equal to three week of training.
Language of instruction:
Finnish or english
Timing:
Master studies, elective course.
Learning outcomes:
The student can undertake tasks in practical working life.
Contents:
Practical training in the field.
Mode of delivery:
Practical training in the field.
Learning activities and teaching methods:
Student find the place for practical training by self and arrange the training together with the contact person.
Target group:
Master Students of Medical and Wellness Technology.
Assessment methods and criteria:
Practical training related to the study area. The student will acquire an agreement with the practical training contact person on the suitability of the proposed training as part of studies. The student will return practical training report and description of training to the depaprtment.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail
Person responsible:
Professor Timo Jämsä
Working life cooperation:
Yes. The purpose of the training is to familiarize the student with the practical working life.
Other information:
Practical Training 2 can be included in the Master's Degree. For more information, please contact assistant Maarit Kangas.

080917S: Project in Biomedical Technology, 5 - 10 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS
Language of instruction:
Finnish or English
Timing:
Master studies
Learning outcomes:
The student is abel to solve a research problem and report it in writing.
Contents:
Performing a small ressearch project.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
The student participates in a research project within or outside the university. The student prepares a personal project plan according to separate specifications. At the end of the project, the student prepares a written research report and presents it in a seminar.
Target group:
Master Students of Medical and Wellness Technology.
Assessment methods and criteria:
Preparing a project plan, project implementation, preparing a written report and presenting it in seminar.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass or fail.
Person responsible:
Professor Timo Jämsä
Working life cooperation:
No
Other information:
This course is part of the specialization of Biomedical Technology.

080919S: Project in Health Technology, 5 - 10 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS
Language of instruction:
Finnish or English
Timing:
Master studies
Learning outcomes:
The student is able to solve a research problem and report it in writing.
Contents:
Performing a small project.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
The student participates in a research project within or outside the university. The student prepares a personal project plan according to separate specifications. At the end of the project, the student prepares a written research report and presents it in a seminar.
Target group:
Master Students of Medical and Wellness Technology.
Assessment methods and criteria:
Preparing a project plan, project implementation, preparing a written report and presenting it in a seminar.

Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass or fail
Person responsible:
Professor Timo Jämsä
Working life cooperation:
No
Other information:
This course is a part of the specialization of Health Technology.

080918S: Project in Medical Imaging, 5 - 10 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
10 ECTS
Language of instruction:
Finnish or English
Timing:
Master studies
Learning outcomes:
The student is able to solve a research problem and perort it written.
Contents:
Performing a samlla research project.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
The student participates in a research project within or outside the university. The student prepares a personal project plan according to separate specifications. At the end of the project, the student prepares a written research report and presents it in a seminar.
Target group:
Master Students of Medical and Wellness Technology
Assessment methods and criteria:
Preparing a project plan, project implementation, preparing a written report and presenting it in a seminar.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass or fail
Person responsible:
Professor Timo Jämsä
Working life cooperation:
No
Other information:
This course is a part of the specialization of Medical Imaging.

080915S: Tissue Biomechanics, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Simo Saarakkala, Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:

4 ECTS
Language of instruction:
English
Timing:
Master studies, Autumn
Learning outcomes:
The student can describe the main biomechanical characteristics of biological materials and different tissues as well as their failure mechanisms. The student knows basics of biomechanical modeling of tissues. The student can perform practical biomechanical experiments, analyze measurement data, interpret results, and report them using good scientific reporting practice.
Contents:
Properties of biological materials. Fatique and failure mechanics. Structure. Composition and mechanics of different tissues. Biomechanical modeling of tissues.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures, exercises, independent work, exam.
Target group:
Students of Medical Technology (medical and wellness technology, biophysics, other degree programs) and all other who are interested
Prerequisites and co-requisites:
Prerequisite: 761101P Basic Mechanics, 031010P Calculus I. Basic knowledge on cell biology, anatomy and physiology, differential aquations and matrix algebra.
Recommended or required reading:
Material given during lectures.
Assessment methods and criteria:
Accepted exercises, written exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Associate Professor Simo Saarakkala
Working life cooperation:
No
Other information:
This course is a part of the specialization of Biomedical Technology

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

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: English

ECTS Credits:
30 ECTS credit points
Language of instruction:
English
Timing:
Master studies
Learning outcomes:
The student can independently solve a research problem, and describe and solve it. The student can report the work in written form according to the scientific report principles.
Contents:
Research project in the field of medical & wellness technology and writing of the thesis.
Mode of delivery:
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:
Master Students of Biomedical Engineering/Biomechanics and Imaging.
Assessment methods and criteria:
Writing the thesis.
Grading:
1-5
Person responsible:
Professor Timo Jämsä
Other information:
It is recommenced to have at least 60 credits before starting the thesis work.

580211S: Maturity Test, 0 op

Voimassaolo: 01.08.2003 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jämsä, Timo Jaakko

Opintokohteen kielet: Finnish

ECTS Credits:
0 ECTS
Timing:
After completion of Master's Thesis.
Learning outcomes:
The student can produce mature text in popular form of the research field and thus show ones familiarity to the field.
Contents:
Depends on the topic of the thesis.
Mode of delivery:
Literary work.
Learning activities and teaching methods:
Takes place after master's thesis. Written based on a given topic considering the thesis.
Target group:
Master Students of Medical and Wellness Technology.
Recommended optional programme components:
Will be written after the Master's Thesis has been submitted for a review.
Assessment methods and criteria:
Student writes an essay in his/her native language about the topic of the Master's thesis to show a good command of the language and the content of the thesis. The abstract of the Master's thesis can be accepted as a maturity test if the student has written a maturity test earlier in Bachelor's degree. If the student's native language or the language of the study programme is another than Finnish or Swedish, the Faculty will define separately the requirements for the maturity test.
Read more about assessment criteria at the University of Oulu webpage.
If the language of the study programme is English, the abstract of the Master's thesis can be accepted as a maturity test if the student has written a maturity test earlier in Bachelor's degree in English. Otherwise the Faculty will define separately the requirements for the maturity test."
Grading:
Pass or fail. The contents will be assessed by the professor of the department. If the student has not made the maturity test as part of the bachelor degree, the language will be assessed by a language consultant.
Person responsible:
Professor Timo Jämsä
Working life cooperation:
No