TFE4100 KRETSTEKNIKK
Kretsteknikk
Electric Circuits

Lecturer: Førsteamanuensis Bojana Gajic, Førsteamanuensis Morten Olavsbråten
Coordinator: Førsteamanuensis Morten Olavsbråten
Weekly hours: Autumn: 3F+7Ø+2S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE4002: 7.5 Cr, SIE4003: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: To give the students a base for understanding, analyzing and designing electrical and electronic circuits. Through laboratory assignments, acquire practical skills using instruments to perform measurements on such circuits.
Recommended previous knowledge: None.
Academic content: Ohms law, Kirchhoff's laws, super position, Thevenin and Norton equivalents, capacitance, inductance, natural- and step responses for RC and RL circuits. Semiconductor devices, such as diodes and MOSFET transistors. Compulsory laboratory assignments for hands-on practical training to become familiar with devices and instruments.
Teaching methods and activities: Lectures, and compulsory theory and laboratory assignments. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Announced at course start.
Assessment: Written examination/Midterm

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	70/100	D
MIDTERM EXAMINATION		30/100	D

TFE4105 DIGITALTEK DATAMASK
Digitalteknikk og datamaskiner
Digital Design and Computer Fundamentals

Lecturer: Førsteamanuensis Morten Hartmann
Coordinator: Førsteamanuensis Per Gunnar Kjeldsberg
Weekly hours: Autumn: 3F+6Ø+3S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE4005: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: To give the students a base for understanding and designing circuits and systems built with digital electronic circuit elements, and to make computers understandable by discussing the main principles of the organisation and functioning of typical computers. Through assignments and laboratory work, the students shall learn how to apply the acquired theoretical knowledge in practical and independent design work.
Recommended previous knowledge: TDT4100 Object Oriented Programming or similar knowledge in high-level programming
Academic content: First part of the course: Digital design: Number systems, arithmetic operations, coding, boolean algebra, logic gates, simplification methods, combinational logic circuits, sequential circuits, synchronous and asynchronous circuits, flip flops, counters, shiftregisters, memory elements, memory technology, state machines, arithmetic circuits and introduction to programmable logic. Second part of the course: Computer fundamentals: History, computer design on different levels, design hierarchy, algorithmic state machines, programming model, instruction format, addressing modes, CPU organization, data path (arithmetic/logic unit), control unit, microprogramming, RISC, CISC, I/O systems, interrupt, busses, memory hierarchy, cache, virtual memory.
Teaching methods and activities: Lectures. Theory and laboratory assignments. All assignments are compulsory with exception of one of the theory assignments. Intensive period of lectures (2F + 2F each week) in the first part of the semester. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Digital Design and Computer Fundamentals
A Pearson Custom Publication, 2005
The book consists of chapters from
D.D. Gajski: Principles of Digital Design, 1997
M. Mano and C. Kime: Logic and Computer Design Fundamentals, 3rd edition, 2004
Additional material will be sold and/or handed out during the course.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support

WRITTEN	Kunngjøres på nett	70/100	A
MIDTERM EXAMINATION		15/100	D
MIDTERM EXAMINATION		15/100	D

TFE4110 DIGITALTEKN M/KRETST
Digitalteknikk med kretsteknikk
Digital Design and Basic Electrical Circuits

Lecturer: Førsteamanuensis Bjørn B. Larsen
Coordinator: Førsteamanuensis Ragnar Hergum
Weekly hours: Spring: 3F+6Ø+3S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE4006: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises and laboratory assignments

Learning objectives: To give the students a base for understanding and designing circuits and systems built with digital electronic circuit elements, and to give an introduction to electrical concepts and "analog" circuit theory as a fundamental for the understanding of both electrical and computer engineering.
Recommended previous knowledge: TMA4100 Calculus 1, TMA4140 Discrete Mathematics, TDT4110 Information Technology, Introduction, or equivalent knowledge.
Academic content: First part of the cource: Conventions, circuit elements, Kirchoff´s laws, Ohm´s law, simple resistive circuits, techniques of circuit analysis, capacitance and first order RC-circuits.
Second part of the cource: Digital design, number systems, arithmetic operations, coding, boolean algebra, logic gates, simplification methods, combinational logic, flip flops, counters, shiftregisters, memory technology, state machines and introduction to programmable logic.
Teaching methods and activities: Lectures. Theory and labratory assignments in groups of 2 students. All assignments are compulsory except for one theory and one laboratory assignment. Intencive period of lectures (2F + 2F each week) in the first part of the semester. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Information will be given at the start of the semester.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4115 AVANS ELEKTRON SYS
Avanserte elektroniske system
Advanced Electronic Systems

Lecturer: Førsteamanuensis Bojana Gajic, Professor II Kjell A. Ingebrigtsen, Førsteamanuensis Morten Olavsbråten, Professor Andrew Perkis, Professor Gunnar Stette, Professor Thomas Tybell
Coordinator: Førsteamanuensis Morten Olavsbråten
Weekly hours: Spring: 4F+4Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The students shall understand that the implementation of an electronic system requires both a wide scope of professional technical knowledge in addition to electronic circuit design capabilities. They should understand the significance of some basic technical concepts in electronics and telecommunications.
Recommended previous knowledge: Course TFE4100 Circuit Design.
Academic content: Selected electronic systems from diverse applications such as entertainment, telecommunications, medical imaging, and industrial electronics will be analysed in some detail. Emphasis will be put on technology which is critical for the systems functional performance in order to illustrate the trade offs a systems designer may be confronted with. Selected circuit elements will be subject to thorough studies to illustrate the relations between circuit components and systems performance.
Teaching methods and activities: Lectures, laboratory exercises, and group reports. The final marks will be based upon a final written exam (50%), the group reports (30%), and the laboratory exercises (20%). The results for each part is given in % whereas the overall final mark is given in letters. At the delayed exam the final written exam may be replaced by an oral examination.
Course materials: Will be given at the start of the course.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	50/100	D
EXCERCISES		50/100	

TFE4120 ELEKTROMAGNETISME
Elektromagnetisme
Electromagnetics

Lecturer: Professor Johannes Skaar
Weekly hours: Spring: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE4010: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course will provide a fundamental background in basic electromagnetic principles and components.
Recommended previous knowledge: Basic mathematics, vector analysis.
Academic content: Elektrostatics: Coulombs law, scalar potential, Gauss' law, dielectric media, capasitance, currents, resistance, energy. Magnetostatics: Biot-Savarts law, Ampere's law, vector potiential, magnetic materials and circuits, energy and forces.
Electro dynamics: Faraday's law, inductance, transformers, displacement current. Maxwells equations. Electromagnetic waves and Lorenz potentials.
Teaching methods and activities: Lectures and exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Popovic Popovic: Introductory Electromagnetics, Prentice Hall 2000. Lecture notes (in Norwegian).
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TFE4130 BØLGEFORPLANTNING
Bølgeforplantning
Electromagnetic and Acoustic Waves

Lecturer: Professor Helge Emil Engan
Weekly hours: Autumn: 4F+3Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE4015: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course will give a fundamental understanding of propagation of electromagnetic and acoustic waves. This knowledge will be applied to simple problems regarding excitation, detection, and propagation in free space and finite structures.
Recommended previous knowledge: Mathematical treatment of electrostatics, magnetostatics and electrodynamics.
Academic content: Transmission line equations. Characteristic impedance. Reflection and transmission coefficients. Waves with harmonic variation. Dispersion, phase and group velocity. Electromagnetic and acoustic waves in free space. Planar, cylindrical and spherical waves. Field equations in waveguides. TEM, TE and TM waves. Antennas.
Teaching methods and activities: Lectures and exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: D.K. Cheng: Field and Wave Electromagnetics, Addison Wesley. Lecture notes.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4140 MOD AV DIG SYSTEMER
Modellering og analyse av digitale systemer
Modelling and Analysis of Digital Systems

Lecturer: Professor Einar Johan Aas, Førsteamanuensis Per Gunnar Kjeldsberg
Coordinator: Professor Einar Johan Aas
Weekly hours: Spring: 3F+3Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE4020: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: Knowledge and experience with modelling of digital system behaviour and realisation, and analysis and verification of functionality and property of digital systems.
Recommended previous knowledge: Switching theory, design of digital integrated circuits.

Academic content: Modelling and simulation of digital behaviour with a hardware description language, functional verification with equivalence checking, property checking with model checking, logic level and high level synthesis.
Teaching methods and activities: Lectures, self study and term project. Term project is mandatory, and accounts for 25% of final mark. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: To be announced at course startup.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	75/100	A
EXCERCISES		25/100	

TFE4145 ELEKTRONFYSIKK
Elektronfysikk
Semiconductor Physics and Electronic Devices, Introduction

Lecturer: Professor Jostein Grepstad
Weekly hours: Autumn: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE4025: 7.5 Cr
Grade: Letter grade Compulsory assignments: None

Learning objectives: This course should provide a basic understanding of the physics and fabrication of the principal classes of semiconductor devices used in modern microelectronics and photonics.
Recommended previous knowledge: Basic understanding of physics corresponding to the syllabus of topic TFE4215 Solid State Materials and Nanostructures or TFY4220 Solid State Physics.
Academic content: This course provides a detailed introduction to the principal classes of semiconductor devices, applied in modern microelectronics and photonics. The following topics will be treated; charge carrier statistics and transport, luminescence, photoconductivity, p-n junctions, metal- semiconductor contacts, diodes, field-effect transistor (MOSFET), bipolar junction transistor (BJT), light-emitting diodes (LED), laser diodes (LD), photodiodes, and photovoltaic solar cells.
Teaching methods and activities: Auditorium lectures and exercises (problems). Delayed exams (make up exams) may be changed from written to oral.
Course materials: B.G. Streetman and Sanjay Banerjee: Solid State Electronic Devices, 5th edition (or later), Prentice Hall, 2000.
Assessment: Written examination/Midterm

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	75/100	C
MIDTERM EXAMINATION		25/100	C

TFE4151 DESIGN AV INT KRETS
Design av integrerte kretser
Design of Integrated Circuits

Lecturer: Stipendiat Linga Reddy Cenkeramaddi, Førsteamanuensis Bjørn B. Larsen
Coordinator: Førsteamanuensis Bjørn B. Larsen
Weekly hours: Autumn: 4F+3Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: Exercises, Mandatory project

Learning objectives: Give knowledge and experience in analog and digital electronic design and analysis, with emphasis on methods for realisation in MOS-technology.
Recommended previous knowledge: TFE4100 Electric Circuits, TET4100 Circuit Analysis, TTT4100 Electronic Circuits and TFE4105 Digital Design and Computer Fundamentals, or equivalent.
Academic content: CMOS technology, The MOS transistor: Function and characteristic properties. Static and dynamic analysis of logical functions. Fundamental analog building blocks. Simplified layout. Synthesis and design of digital modules. Design for testability. Introduction to CAD tools. Guest lecturers from the electronic industry. Mandatory project: Design and verification of a medium complex analog/digital circuit.
Teaching methods and activities: Lectures, self study and a mandatory project. The final grade is given from the exam (60 %) and the project assignment (40 %). If threre is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Will be announced at course start.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	60/100	D
EXCERCISES		40/100	

TFE4160 ELEKTROOPTIKK/LASERE
Elektrooptikk og lasere
Electrooptics and Lasers

Lecturer: Førsteamanuensis Astrid Aksnes
Weekly hours: Autumn: 3F+4Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE4060: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course will give an introduction to fundamental problems in electrooptics. In addition an understanding will be given of how different lasers function.
Recommended previous knowledge: TFE4130 Electromagnetic and Acoustic Waves or corresponding knowledge.
Academic content: (I) Electrooptics: Waves in isotropic and anisotropic media, dispersion and absorption. Polarization, reflection, refraction, Jones formalism, optical activity, Faraday effect. Interference and coherence. Fourier optics and gaussian beams. (II) Lasers: Optical cavities. Amplifier media. Amplification saturation and hole burning. Pulsed lasers, Q switching, cavity dumping and mode locking.
Teaching methods and activities: Lectures, tutorials, laboratory exercises and mid-term exam. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: E.A.Saleh, M.C.Teich: Fundamentals of Photonics.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TFE4165 ANVENDT FOTONIKK
Anvendt fotonikk
Applied Photonics

Lecturer: Professor II Dag Roar Hjelme
Weekly hours: Spring: 3F+4Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE4065: 7.5 Cr
Grade: Letter grade Compulsory assignments: Laboratory exercises

Learning objectives: The course shall give an introduction to practical components and systems based on electro-optic and related effects.
Recommended previous knowledge: TFE4160 Electrooptics and Lasers or corresponding knowledge.
Academic content: Optical waveguides, integrated optics, and optical fibers. Electro-optics, nonlinear optics and acusto-optics. Scattering. Waveguide components, optical modulators and switches. Photodetectors. Applications in optical communication, fiberoptic sensors, and optical metrology.
Teaching methods and activities: Lectures, tutorials and laboratory exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: E.A.Saleh, M.C.Teich: Fundamentals of Photonics.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4170 ENBRIKKESYSTEMER
Enbrikkesystemer
System-on-a-Chip

Lecturer: Professor Kjetil Svarstad
Weekly hours: Spring: 2F+6Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: To gain an understanding of Systems on Chip, what they are and what characterises them. To build a foundation for designing systems on chip from the specification level and down to synthesisable hardware and software.
Recommended previous knowledge: Prerequisites: TFE4140 Modeling and Analysis of Digital Systems (knowledge of the concept of modelling and simulating hardware), and TFE4175 Realisation and Testing of Digital Components (knowledge of the concept of description and verification of components and systems of hardware), or comparable documented knowledge.
Academic content: System On Chip definition; an overview of system description languages; using UML for SOC specification; an introduction to SystemC; specification; co-design; co-verification; Intellectual Property Components, On-chip communication: Bus systems and network-on-chip; use of system design tools for complete system simulation.

Teaching methods and activities: Lectures. Practical, theoretical exercises, and lab exercises which is part of dossier that is evaluated and counts for 40% of final mark. A final exam counts for 60% of final mark. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: To be decided.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	60/100	B
EXCERCISES		40/100	

TFE4175 REALISER AV DIG KOMP
Realisering og test av digitale komponenter
Realization and Test of Digital Components

Lecturer: Professor Einar Johan Aas, Førsteamanuensis Bjørn B. Larsen
Coordinator: Professor Einar Johan Aas
Weekly hours: Autumn: 2F+6Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English, Norwegian
SP-reduksjon: SIE4075: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: Obtain knowledge and experience with methods for realisation and test of digital components, and gain skills in electronic lab, and in use of state-of-the-art EDA tools.
Recommended previous knowledge: Prerequisites: Course TFE4140 Modelling and Analysis of Digital Systems, or similar knowledge. Working knowledge of an HDL, and switching theory.
Academic content: Design methodology. Automated and manual synthesis of digital modules and components. Realisation with standard cells or FPGAs. Use of integrated EDA systems. Timing analysis. Partitioning, placement and routing. Test issues: fault models, test generation, fault simulation, Design for Testability, BIST, test quality, test economics. Test equipment and test standards.
Teaching methods and activities: Lectures, self study, project and lab assignments. Project counts 25%, lab counts 15% of final grade. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: To be decided.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	60/100	A
EXCERCISES		40/100	

TFE4180 HALVLEDERTEKNOLOGI
Halvleder komponent- og kretsteknologi
Semiconductor Manufacturing Technology

Lecturer: Professor Bjørn-Ove Fimland
Weekly hours: Autumn: 3F+4Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE4080: 7.5 Cr
Grade: Letter grade Compulsory assignments: Laboratory exercises, Presentation , Problem solving exercises

Learning objectives: Introduction to semiconductor thin film technology for fabrication of electronic and photonic devices and integrated circuits.
Recommended previous knowledge: Basic knowledge of physics and mathematics at university level.
Academic content: Bulk and epitaxial growth of semiconductors. Compound semiconductor heterostructures and superlattices. The assessment of semiconductors by electrical techniques (resistivity, mobility, Hall effect, C-V techniques), by diffraction (XRD, RHEED, LEED), by ion beam techniques (SIMS, ASP), and by microscopy and imaging (optical, SEM, TEM, STM, AFM). Processing of semiconductor devices and integrated circuits.
Teaching methods and activities: Lectures, excercises, presentations by the students, laboratory demonstrations, and laboratory excercises in clean room. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: To be announced at start-up.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4186 ANALOG CMOS 1
Analog CMOS 1
Analog CMOS 1

Lecturer: Professor Trond Ytterdal
Weekly hours: Autumn: 3F+6Ø+3S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Semester assignment

Learning objectives: The course will give a theoretical fundament for analog signal processing and design of analog integrated circuits. Also, the course will provide practical skills in design and simulation of analog integrated circuits realized in CMOS technology.
Recommended previous knowledge: TFE4200 Analog Integrated Circuits or equivalent prerequisites.
Academic content: Theory for analog signal processing, implementation of analog and discrete-time filters. Sample-and-hold circuits, switched-capacitor circuits, data converter fundamentals, advanced transistor modeling, RF CMOS. Use of electronic design automation tools.
Teaching methods and activities: Lectures. Assignments, both theoretical and computer based. Mandatory term project. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Announced at startup.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4191 ANALOG CMOS 2
Analog CMOS 2
Analog CMOS 2

Lecturer: Professor Trond Sæther
Weekly hours: Spring: 2F+6Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course will give a theoretical fundament for data converters and implementation of such systems in CMOS technology. Also, the course will provide and introduction to design methodologies for analog and mixed-signal CMOS integrated circuits. In addition, the course will give practical experience in design and simulation of such systems.
Recommended previous knowledge: TFE4186 Analog CMOS 1 or equivalent prerequisites.
Academic content: Theory and techniques for analog-to-digital and digita-to-analog data converters including delta-sigma modulators. Design and implentation of data converters in CMOS technology. Methodology and EDA tools for design of analog and mixed-signal integrated circuits.
Teaching methods and activities: Lectures. Assignments, both theoretical and computer based. Mandatory term project. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Announced at startup.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	65/100	D
EXCERCISES		35/100	

TFE4200 ANALOGE INT KRETSER
Analoge integrerte kretser
Analog Integrated Circuits

Lecturer: Universitetslektor Tajeshwar Singh, Stipendiat Carsten Wulff
Coordinator: Førsteamanuensis Ragnar Hergum
Weekly hours: Spring: 3F+6Ø+3S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The main objective of the course is to provide an introduction to the design and simulation of analog integrated circuits.
Recommended previous knowledge: Transistor theory, small signal equivalent circuits for MOS and BJT, general circuit analysis techniques, control systems theory, s-domain analysis.
Academic content: Frequency response, amplifier topologies, feedback, noise analysis, opertaional amplifiers, comparators, sample-and-hold circuits. Use of the SPICE simulation program.
Teaching methods and activities: Lectures. Assignments, both theoretical and computer based. If there is a re-sit examination, the examination form may be changed from written to oral.

Course materials: Announced at course start.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4210 NANOELEKTRONIKK
Nanoelektronikk
Nanoelectronics

Lecturer: Professor Thomas Tybell
Weekly hours: Spring: 3F+3Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course gives an overview of modern questions on future electronics, and highlights electronic materials for applications in future informationtechnology with emphasis on nanoelectronics.
Recommended previous knowledge: TFE4145 or equivalent.
Academic content: Introduction to quantum mechanics, one-electron transistors and one-electron electronics, magnetoelectronics and spintronics, Non-volatile memory technology for ultra high density memories, evolution of todays DRAM technology, and emerging fields such as molecular electronics
Teaching methods and activities: Lectures, excercises, student presentations, and self-study. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices by Rainer Waser (Editor), Wiley-VCH, ISBN: 3527403639.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TFE4215 FASTSTOFF NANOSTRUKT
Faststoff-materialer og nanostrukturer
Solid State Materials and Nanostructures

Lecturer: Professor Helge Weman
Weekly hours: Spring: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The goal of the course is to give the students a basic knowledge of solid state materials with a special emphasis of their geometric, electronic, optical and magnetic properties. With this knowledge an understanding of solid state materials static and dynamical properties will be achieved for further use when analyzing such materials in reduced dimensions.
Recommended previous knowledge: Basic knowledge of physics at the level of course TFY4170.
Academic content: Introduction to quantum mechanics, crystal structure, reciprocal lattice,Brillouin zones, phonons, free electron gas, electrons in a periodic lattice, energy band model, semiconductors, optical properties, excitons, di- and ferro-electrics, dia- and para-magnetism, ferro- and antiferro-magnetism, solid state materials in reduced dimensions, nanostructures.
Teaching methods and activities: Lectures and compulsory exercises. 2/3 of the exercises have to be passed before the written exam. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Announced at course start.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TFE4220 NANOTEKN INTRO
Nanoteknologi, introduksjon
Introduction to Nanotechnology

Lecturer: Professor Thomas Tybell
Weekly hours: Autumn: 4F+4Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Pass/Fail Compulsory assignments: None

Learning objectives: The subject gives an introduction to central themes within nanotechnology, with emphasis on how this cross-disciplinary technology can increase understanding and promote novel products.
Academic content: The cource will present an analysis of areas of relevance to subjects such as bionanotechnologu, nanostructured materials, and nanoelectronics. The cource will focu on common techniques in order to understand the possibilites of nanotechnology. A section on ethical and environmental issues will also be presented.

Teaching methods and activities: Lectures, mandatory excercises, and groupwork. A continious evaluation based on the excrecises and groupworks will be used, each will be graded in procent.
Course materials: Will be given at the start of the semester.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TFE4225 MEMS-DESIGN
MEMS-design
MEMS-design

Lecturer: Professor II Ralph William Bernstein
Weekly hours: Autumn: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course will give the principles for and an introduction to micro- and nanofabrication in silicon technology of sensors and actuators.
Required previous knowledge: TKT4116 Mechanics 1 or corresponding knowledge.
Academic content: An introduction to micro- and nanofabrication with focus on silicon technology for fabrication of sensors and actuators. Basic mechanics for design of microelectromechanical systems (MEMS) is given together with different principles for sensors and actuators based on piezoresistivity, capacitance, thermal effects, piezoelectricity and optic effects. Design and fabrication of different sensors as pressure sensors, accelerometers, gyroscopes, and gas sensors is given in detail. In addition one will discuss optic, thermal, chemical and biological sensors and actuators and their applications.
Teaching methods and activities: Lectures, tutorials. If there is a re-sit examination, the examination form may be changed from oral to written.
Course materials: Will be given at the start of the course.
Assessment: Oral examination

Forms of assessment	Date/Time	Percentage	Exam. support
ORAL EXAMINATION	Kunngjøres på nett	100/100	D

TFE4520 DES DIG SYST FDP
Design av digitale systemer, fordypningsprosjekt
Digital System Design, Specialization Project

Lecturer: Professor Einar Johan Aas, Førsteamanuensis Per Gunnar Kjeldsberg, Førsteamanuensis Bjørn B. Larsen, Professor Kjetil Svarstad
Coordinator: Professor Einar Johan Aas
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: TFE4700: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: The student shall learn to perform an in-depth study of a specific topic within design of digital systems.
Teaching methods and activities: Independent project work under supervision.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TFE4525 DES DIG SYST FDE
Design av digitale systemer, fordypningsemne
Design of Digital Systems, Specialization Course

Lecturer: Professor Einar Johan Aas, Førsteamanuensis Per Gunnar Kjeldsberg, Førsteamanuensis Bjørn B. Larsen, Professor Kjetil Svarstad
Coordinator: Professor Einar Johan Aas
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English, Norwegian
SP-reduksjon: TFE4700: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Various specializations in digital system design.

Recommended previous knowledge: Courses TFE4175 Realisation and Test of Digital Components, and TFE4170 System-on-Chip, or similar.
Academic content: This specialization course encompasses one term project (15 stp) and two electives, each of 3,75 stp. Topics of specialization: low power digital design - Hardware/software codesign with embedded systems - Built-in Self-test of digital systems - High level synthesis and verification - Dynamic reconfigurable systems.
Teaching methods and activities: Supervised term project. Lectures, self study, seminars. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: To be decided.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4530 FOTONIKK FDP
Fotonikk, fordypningsprosjekt
Photonics, Specialization Project

Lecturer: Førsteamanuensis Astrid Aksnes, Professor Helge Emil Engan, Professor II Dag Roar Hjelme, Professor Johannes Skaar, Professor Lars O. Svaasand
Coordinator: Professor Johannes Skaar
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4705: 15.0 SP TFE4710: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization projects in photonics.
Recommended previous knowledge: For students in the programme Electronics with main profile Photonics.
Teaching methods and activities: Individual projects with supervision.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TFE4535 FOTONIKK FDE
Fotonikk, fordypningsemne
Photonics, Specialization Course

Lecturer: Førsteamanuensis Astrid Aksnes, Professor Helge Emil Engan, Professor II Dag Roar Hjelme, Professor Johannes Skaar, Professor Lars O. Svaasand
Coordinator: Professor Johannes Skaar
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4705: 7.5 SP TFE4710: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization knowledge in photonics.
Recommended previous knowledge: For students in the programme Electronics and Communications Technology with main profile Photonics.
Academic content: The student shall choose two elective themes of 3.75 stp each or one elective theme of 7.5 stp. Possible themes are: TFE12 Medical sensors (3.75 stp), TFE13 Fiber components (3.75 stp), TFE11 MEMS and MOEMS (3.75 stp).
Teaching methods and activities: The elective themes can be taught through lectures, seminars and self studies. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Will be announced at the beginning of the semester.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4540 ANALOG/BL DESIGN FDP
Analog og blandet design, fordypningsprosjekt
Analog and Mixed Design, Specialization Project

Lecturer: Professor Tor A Fjeldly, Førsteamanuensis Ragnar Hergum, Professor Trond Sæther, Professor Trond Ytterdal
Coordinator: Professor Trond Ytterdal
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TFE4705: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization projects in analog and mixed-signal design. The student performs an in-depth study of a specific topic using scientific work methods. This involves the search for completing material through literature surveys and combining results from such with personal knowledge. The student should learn to carry out a larger independent project. This includes project planning, reporting milestone results, and writing a final project report.
Recommended previous knowledge: TFE4186 Analog CMOS 1 and TFE4191 Analog CMOS 2 or similar prerequisites.
Academic content: Methodology and technology for design of analog and mixed-signal integrated circuits for different applications, such as, for example, ASIC for MEMS, CMOS RF and data converters with focus on low-voltage/low-power.
Teaching methods and activities: Individual projects with supervision.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TFE4545 ANALOG/BL DESIGN FDE
Analog og blandet design, fordypningsemne
Analog and Mixed Design, Specialization Course

Lecturer: Professor Tor A Fjeldly, Førsteamanuensis Ragnar Hergum, Professor Trond Sæther, Professor Trond Ytterdal
Coordinator: Professor Trond Ytterdal
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TFE4705: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course provides specialization in design of analog- and mixed-signal integrated circuits for a wide range of applications.
Recommended previous knowledge: TFE4186 Analog CMOS 1 and TFE4191 Analog CMOS 2 or similar prerequisites.
Academic content: This specialization course encompasses two electives. Topics of specialization: ASIC for MEMS, Integrated RF CMOS Design, Data converters, Low voltage/Low power analog integrated circuits.
Teaching methods and activities: Lectures, self study, seminars. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Announced at course start.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4550 MIKROTEKN FDP
Mikroteknologi, fordypningsprosjekt
Microtechnology, Specialization Project

Lecturer: Professor II Ralph William Bernstein, Professor Bjørn-Ove Fimland, Professor Jostein Grepstad, Professor II Kjell A. Ingebrigtsen, Professor Arne Rønnekleiv, Professor Thomas Tybell, Professor Helge Weman
Coordinator: Professor Arne Rønnekleiv
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TFE4715: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization in microtechnology.
Recommended previous knowledge: For students in the programme Electronics with main profile Microtechnology.
Teaching methods and activities: Individual projects with supervision.

Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TFE4555 MIKROTEKN FDE
Mikroteknologi, fordypningsemne
Microtechnology, Specialization Course

Lecturer: Professor II Ralph William Bernstein, Professor Bjørn-Ove Fimland, Professor Jostein Grepstad, Professor II Kjell A. Ingebrigtsen, Professor Arne Rønnekleiv, Professor Thomas Tybell, Professor Helge Weman
Coordinator: Professor Arne Rønnekleiv
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TFE4715: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Give specialization knowledge in nanoelectronics and microsystems.
Recommended previous knowledge: For students in the programme Electronics and Communications Technology with main profile Microtechnology. For all themes TFE4145 Semiconductor Physics and Electronic Devices, Introduction, and TFE4130 Electromangnetic and Acoustic Waves or similar. TFE4160 Electrooptics and Lasers or similar is required for TFE12 Medical Sensors and TFE13 Fiber Components. TFE4186 Analog CMOS 1 or similar is required for TFE6 ASIC for MEMS.
Academic content: The student shall choose two elective themes of 3.75 stp each or one elective theme of 7.5 stp. Possible themes are: TFE12 Medical sensors (3.75 stp), TFE13 Fiber components (3.75 stp), TFE11 MEMS and MOEMS (3.75 stp).
Teaching methods and activities: The elective themes can be taught through lectures, seminars and self studies. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Will be announced at the beginning of the semester.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4560 NANOELEKTR/MIKR FDP
Nanoelektronikk og mikrosystemer, fordypningsprosjekt
Nanoelectronics and Microsystems, Specialization Project

Lecturer: Professor Bjørn-Ove Fimland, Professor Jostein Grepstad, Professor II Kjell A. Ingebrigtsen, Professor Arne Rønnekleiv, Professor Thomas Tybell, Professor Helge Weman
Coordinator: Professor Arne Rønnekleiv
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Not lectured in study year 2007-2008
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization projects in nanoelectronics and microsystems.
Recommended previous knowledge: For students in the programme Electronics with main profile Nanoelectronics and microsystems.
Teaching methods and activities: Individual projects with supervision.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TFE4565 NANOELEKTR/MIKR FDE
Nanoelektronikk og mikrosystemer, fordypningsemne
Nanoelectronics and Microsystems, Specialization Course

Lecturer: Professor Bjørn-Ove Fimland, Professor Jostein Grepstad, Professor II Kjell A. Ingebrigtsen, Professor Arne Rønnekleiv, Professor Thomas Tybell, Professor Helge Weman
Coordinator: Professor Arne Rønnekleiv
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Not lectured in study year 2007-2008
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: None

Learning objectives: Give specialization knowledge in nanoelectronics and microsystems.
Recommended previous knowledge: For students in the programme Electronics and Communications Technology with main profile Nanoelectronics and Microsystems. For all themes TFE4145 Semiconductor Physics and Electronic Devices, Introduction, and TFE4130 Electromangnetic and Acoustic Waves or similar. TFE4160 Electrooptics and Lasers or similar is required for TFE12 Medical Sensors and TFE13 Fiber Components. TFE4186 Analog CMOS 1 or similar is required for TFE6 ASIC for MEMS.
Academic content: The student shall choose two elective themes of 3.75 stp each or one elective theme of 7.5 stp. Possible themes are: TFE12 Medical sensors (3.75 stp), TFE13 Fiber components (3.75 stp), TFE11 MEMS and MOEMS (3.75 stp).
Teaching methods and activities: The elective themes can be taught through lectures, seminars and self studies. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Will be announced at the beginning of the semester.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TFE4610 MIKROEL/FOTONIKK FDP
Mikroelektronikk og fotonikk, fordypningsprosjekt ved UniK
Microelectronics and Photonics, Project at UniK

Coordinator: Professor Tor A Fjeldly
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TFE4600: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course provides experience in project work in microelectronics and photonics.
Recommended previous knowledge: Courses TFE4145 Semiconductor Physics and Electronic Devices, Introduction, TFE4200 Analog Integrated Circuits and TFE4186 Analog CMOS1 or comparable.
Teaching methods and activities: Individual project work with supervision.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TFE4615 MIKROEL/FOTONIKK FDE
Mikroelektronikk og fotonikk, fordypningsemne ved UniK
Microelectronics and Photonics, Specialization at UniK

Coordinator: Professor Tor A Fjeldly
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course provides specialization in understanding and application of advanced electronic devices and electronic circuits or in applied optics.
Recommended previous knowledge: Courses TFE4145 Semiconductor Physics and Electronic Devices, Introduction, TFE4200 Analoge Integrated Circuits, TFE4186 Analog CMOS1 and TFE4130 Electromagnetic and Acoustic Waves or comparable.
Academic content: The specialization course consists of one topic. This can be selcted among the courses taught at UniK in the areas of semiconductor technology, electronic devices, electronic circuits, laser physics, and optical fiber technology. List of courses: UNIK 4320 Quality management and metrology, UNIK 4340 Laser physics, UNIK 4350 Fiberoptic broadband networks, UNIK 4370 Device modeling and circuit simulation, UNIK 4400 Imaging Radar, UNIK 4410 High-level circuit design of digital integrated circuits, UNIK 4450 Solar cells, UNIK 4530 Surveillance and monitoring, UNIK 4540 Mathematical modelling of dynamic systems, UNIK 4590 Pattern recognotion, UNIK 4600 Mathematical modeling techniques for physical systems.
Teaching methods and activities: The teaching may consist of lectures, seminars and self study. The exam constitutes the basis for a final grade in the course. In case of continuation exams, these will be arranged before the end of the same exam period.
Course materials: Announced at semester start.
Assessment: Oral examination

Forms of assessment	Date/Time	Percentage	Exam. support
ORAL EXAMINATION	Kunngjøres på nett	100/100	D

TFE4620 RADIOKOMM/FJM FDP
Radiokommunikasjon og fjernmåling, fordypningsprosjekt ved UniK
Radio Communication and Remote Sensing, Project at UniK

Coordinator: Professor Tor A Fjeldly
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TFE4605: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course provides experience in project work in radio communication and remote sensing.
Recommended previous knowledge: Courses TTT4115 Communications, TTT4145 Radio Communications and TTT 4155 Remote Sensing or comparable.
Teaching methods and activities: Individual project work with supervision.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TFE4625 RADIOKOMM/FJM FDE
Radiokommunikasjon og fjernmåling, fordypningsemne ved UniK
Radio Communication and Remote Sensing, fordypningsemne ved UniK

Coordinator: Professor Tor A Fjeldly
Weekly hours: Autumn: 2F+6Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TFE4605: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course provides specialization in understanding and applications of advanced radio communication and remote sensing.
Recommended previous knowledge: Courses TTT4115 Communications, TTT4145 Radio Communications and TTT4155 Remote Sensing or comparable.
Academic content: The specialization course consists of one topic. This can be selected from the courses taught at UniK in the areas of radiokommunication and remote sensing. List of courses: UNIK 4100 Satellite Communications, UNIK 4110 Fixed Broadband Wireless Access, UNIK 4140 Man - Machine ? Interaction, UNIK 4160 Introduction to wireless communications, UNIK 4260 Vulnerability and Security of Wireless Communications, UNIK 4400 Imaging Radar, UNIK 4530 Surveillance and monitoring, UNIK 4540 Mathematical modelling of dynamic systems, UNIK 4590 Pattern recognotion, UNIK 4600 Mathematical modeling techniques for physical systems.
Teaching methods and activities: The teaching may consist of lectures, seminars and self study. The exam constitutes a basis for the final grade in the course. In case of continuation exams, these will be arranged before the end of the same exam period.
Course materials: Announced at semester start.
Assessment: Oral examination

Forms of assessment	Date/Time	Percentage	Exam. support
ORAL EXAMINATION	Kunngjøres på nett	100/100	D

TFE4900 SIGNALBEH KOM
Signalbehandling og kommunikasjon, masteroppgave
Signal Processing and Communication, Master Thesis

Lecturer: NN
Weekly hours: Spring: = 30.0 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Assessment: Thesis

Forms of assessment	Date/Time	Percentage	Exam. support

TFE4905 KRETS SYSTEMKONSTR
Krets- og systemkonstruksjon, masteroppgave
Circuits and Computer Systems, Master Thesis

Lecturer: NN
Weekly hours: Spring: = 30.0 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Assessment: Thesis

Forms of assessment	Date/Time	Percentage	Exam. support

TFE4910 FOTONIKK MIKROTEKN
Fotonikk og mikroteknologi, masteroppgave
Photonics and Micro Technology, Master Thesis

Lecturer: NN
Weekly hours: Spring: = 30.0 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Assessment: Thesis

Forms of assessment	Date/Time	Percentage	Exam. support

TFE4915 KRETS SYSTEMDESIGN
Krets- og systemdesign, masteroppgave
Circuits- and Systems Design, Master Thesis

Lecturer: NN
Weekly hours: Spring: = 30.0 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Assessment: Thesis

Forms of assessment	Date/Time	Percentage	Exam. support

TFE4920 NANOELEKTR FOTONIKK
Nanoelektronikk og fotonikk, masteroppgave
Nanoelectronics and Photonics, Master Thesis

Lecturer: NN
Weekly hours: Spring: = 30.0 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Assessment: Thesis

Forms of assessment	Date/Time	Percentage	Exam. support

TT2010 MUSIKK OG SANSNING
Musikk og sansning
Music Signal and Audio Perception

Lecturer: Amanuensis Jan Tro
Weekly hours: Spring: 2F+2Ø+8S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: TTX/H03: 7.5 Cr
Grade: Letter grade Compulsory assignments: Excercises

Learning objectives: Building a foundation for further work in music and media production.
Academic content: This course gives basic introduction to sound description and signal analyses, hearing mechanism (audiology), sound perception and music psychology. Sound examples and listening exercises.
Teaching methods and activities: Lectures, exercises and aural training.
Course materials: Articles and book chapters
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	1/1	D

TT3010 AUDTEK OG ROMAKK
Audioteknologi og romakustikk
Audio Technology and Room Acoustics

Lecturer: NN
Weekly hours: Autumn: 2F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: MUST3052: 7.5 SP
Grade: Letter grade Compulsory assignments: Exercises , satisfactory participation in compulsory instruction

Learning objectives: The course should provide basic insight in acoustic communication and sound systems, with special focus on practical possibilities and limitations for music performance and audio recording.
Required previous knowledge: Requires admission to the Master's programme in Music Technology.
Academic content: The course provides basic introduction to acoustic waves, transformers, and techniques for audio recording and audio reproduction, moreover methods for calculation of audio behaviour in rooms, with a special focus on practical consequences for music performance.
Teaching methods and activities: Lectures: 2 hours per wekk for 12 weeks. Exercises. Midterm exams will be a practical assignment, and the result of this assigment will be presented for example as a report or a music production.
Assessment: Assignment/Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
ASSIGNMENT		1/4	
WRITTEN	Kunngjøres på nett	3/4	

TTT4100 ELEKTRONISKE KRETSER
Elektroniske kretser
Electronic Circuits

Lecturer: Førsteamanuensis Morten Olavsbråten
Weekly hours: Spring: 3F+7Ø+2S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE2005: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: This course shall give a first introduction to the use of electronic components and circuits in signal transmission systems. Laboratory exercises will show examples of such components and circuits.
Academic content: Non-iedal effects in operational amplifiers and transistors,frequency-and signal level limitations, input-and output impedances. Passive and active filters, time-and frequency domain relations, phase locked loops, modulators and detectors.
Teaching methods and activities: Lectures and laboratory exercises. The laboratory exercises are an integral part of the course and questions from this part will be included in the exam - on equal level as the theoretical part of the course. Each student shall write one laboratory report. If there is a re-sit examination, the examination form may be changed from written to oral.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TTT4110 INFO OG SIGNALTEORI
Informasjons- og signalteori
Information and Signal Theory

Lecturer: Professor Tor Audun Ramstad
Weekly hours: Spring: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE2010: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course will give a first introduction to methods for mathematical analysis and processing of information carrying signals and how these can be stored and transmitted.
Recommended previous knowledge: The courses TMA4100 Calculus 1, TMA4115 Calculus 3 og TMA4240 Statistics or equivalent knowledge are prerequisites.
Academic content: Signal representations in time and frequency domains. Sampling. Digital coding of signals. Filtering. Information contents of signals. Digital baseband transmission. Channel capacity.
Teaching methods and activities: Lectures and exercises. If there is a re-sit examination, the examination form may be changed form written to oral.

Course materials: Tor Ramstad: Representing Information by Signals.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	70/100	D
MIDTERM EXAMINATION		15/100	D
EXCERCISES		15/100	

TTT4115 KOMMUNIKASJONSTEORI
Kommunikasjonsteori
Communications

Lecturer: Førsteamanuensis Torbjørn Ekman
Weekly hours: Spring: 3F+4Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE2020: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: Modern telecommunications services require that the capacity of communication channels is exploited in an econoomical way. To do this, engineers must be able to characterize signals and transmission media in order to design optimal systems. The aim of this course is to give an introduction to the most central problems related to modern transmission systems with emphasis on mathematical and statistical models.
Recommended previous knowledge: The courses TTT4110 Information and Signal Theory and TMA4245 Statistics, or equivalent.
Academic content: The first part of the course covers random processees which are used to describe classes of information carrying signals such as speech and video. The second part treats methods for efficient source coding (compression) and signal transmission. Central topics are digital compression, analog and digital modulation, baseband and bandpass transmission.
Teaching methods and activities: Lectures and exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Simon Haykin: Communication Systems, 4th ed., Wiley, 2001.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4120 DIG SIGNALBEHANDLING
Digital signalbehandling
Digital Signal Processing

Lecturer: Førsteamanuensis Magne Hallstein Johnsen
Coordinator: Førsteamanuensis Bojana Gajic
Weekly hours: Autumn: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE2024: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: In this course the students will:
a) learn the basic methods for processing of discrete signals and systems.
b) gain a basic understanding of analysis, modeling and estimation of real world stochastic signals.
Recommended previous knowledge: Course TTT4110 Information and Signal Theory or TTK4105 Control Systems or equivalent background.
Academic content: Digital signal processing (DSP) plays a major role in the fast development of new methods within areas as telecommunication, multimedia, medicine, seismics, remote sensing, monitoring and control of industrial processes, and so on. DSP may be defined as the set of mathematical tools which is used to analyse, model or transform physical (real world) signals/processes and sources. This includes basic operations like filtering and frequency analyzis, but also methods/systems for modeling, estimation and classification. The following topics are taught: time, frequency and z-domain description of discrete signals and linear time-invariant systems; analysis and design of filters; multirate systems, correlation and energy spectrum; statistical properties, modeling and estimation of discrete stochastic processes.
Teaching methods and activities: Lectures, compulsory homework problems and computer exercises in Matlab. The midterm examination will only count in a positive direction. If the result of the midterm examination is poorer than the result in the written examination, the final grade will be based on the written examination alone. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: The course material is announced at the first lecture.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support

WRITTEN	Kunngjøres på nett	80/100	D
MIDTERM EXAMINATION		20/100	D

TTT4125 INFORMASJONSTEORI
Informasjonsteori, koding og kompresjon
Information Theory, Coding and Compression

Lecturer: Professor Ralf Reiner Müller
Weekly hours: Autumn: 4F+1Ø+7S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English
SP-reduksjon: SIE2035: 7.5 Cr
Grade: Letter grade Compulsory assignments: None

Learning objectives: The purpose of the course is twofold. Fisrtly, it aims at gving the student an understanding of formal mathematical models of information and communication that enables a quantifiacation of the theoretically optimal performance of a communication system. Secondly, the student should get insigth in how these theoretical limits can be reached through practical algorithms and methods.
Recommended previous knowledge: TTT4115 Communications or equivalent.
Academic content: Modelling and analysis of components in a generic communication system. Mathematical definitions of information content and channel capacity. Principles for optimal information transfer across various types of channels. Lossless data compression. Rate Distortion theory. Principles and methods for practical digital representations. Practical channel coding. Performance assessment relative to information theoretic limits.
Teaching methods and activities: Lectures and voluntary exercises. Postponed/repeated exams may be oral.
Course materials: T. Cover J. Thomas, Elements of Information Theory, 2nd ed, Wiley, 2006. J. Huber: Information Theory and its Applications in Communications Engineering, Lecture Notes, Erlangen, Germany 2002.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4130 DIG KOMMUNIKASJON
Digital kommunikasjon
Digital Communication

Lecturer: Professor Nils Holte
Weekly hours: Autumn: 3F+2Ø+7S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE2045: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course intends to give a basic introduction to principles and systems for transmission of digital information in different types of transmission channels.
Recommended previous knowledge: Courses TTT4120 Digital Signal Processing and TTT4115 Communications or equivalent knowledge.
Academic content: Principles for design of transmitters and receivers for digital transmission. Examples of channel models; twisted pair cables, fibreoptical transmission. Baseband transmission, line codes, digital modulation methods, symbol by symbol detection, optimum methods of detection, the Viterbi algorithm, adaptive equalisation, timing- and carrier recovery.
Teaching methods and activities: Lectures and excercises. There will be two compulsory computer based excercises plus a set of voluntary excercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: J R Barry, E A Lee, D G Messerschmitt, Digital Communication, 3'rd ed, Kluwer Academic Publishers, 2004.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4135 MULTIMEDIA SIGNALBEH
Multimedia - signalbehandling
Multimedia Signal Processing

Lecturer: Professor Andrew Perkis
Weekly hours: Spring: 3F+3Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE2070: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The subject should provide understanding of advanced techniques, algorithms and concepts for digital processing of audiovisual information. The processing will be highlighted by applications from multimedia systems.
Recommended previous knowledge: TTT4120 Digital Signal Processing or equivalent.
Academic content: The course treats audiovisual signals (speech, audio, images and video) and their characteristics relevant to applications in multimedia systems as well as principles and methods for digital processing of audiovisual information. The topics covered are: Statistical characterisation, parametric modelling and digital representation of speech, audio, images, video and graphics. Principles and algorithms for compression of speech, audio, images and video. Combined processing of different media types such as manipulation and integration of audiovisual information. Synthetic images and graphics. Annotation of audiovisual information and methods for search and retrieval of audiovisual information. Multimedia processors and implementation issues of multimedia systems. Multimedia applications, interactivity, multimedia presentations.
Teaching methods and activities: Lectures, voluntary exercises, mandatory computer exercises. Postponed/repeated exams may be oral.
Course materials: Jerry Gibson, Toby berger, Tom Lookabaugh, Dave Linbergh and Richard Baker: Digital Compression for Multimedia: Principles and standards, Morgan Kaufmann publishers, 1998.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4140 NAVIGASJON
Navigasjon
Fundamentals of Navigation

Lecturer: Professor Børje Forssell
Weekly hours: Autumn: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE2030: 7.5 Cr
Grade: Letter grade Compulsory assignments: None

Learning objectives: To give students knowledge of the fundamental geodetic, mathematical and statistical requirements for design and utilisation of navigation systems and navigational data.
Recommended previous knowledge: Knowledge of Mathematics and Mathematical Statistics corresponding to a Bachelor's degree in Engineering Sciences at NTNU.
Academic content: The geophysical and geodetical fundamentals of navigation, positioning and localisation, i.e. shape and physics of the earth, reference and coordinate systems, maps and mapping projections, calculations on the surface of the earth, satellite navigation, error calculations and optimised utilisation of navigational data, particularly Kalman filtering.
Teaching methods and activities: Lectures and exercises. 10 exercises with solutions are available on the web site. The course can be held in English if international students attend. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: B. Forssell: Radionavigation Systems, Prentice Hall 1991(reproduced by Tapir). R. Grover Brown, P.Y.C. Hwang: Introduction to random signals and applied Kalman filtering, 3rd ed., John Wiley og Sons, Inc. 1997. Lecture notes.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4145 RADIOKOMMUNIKASJON
Radiokommunikasjon
Radio Communications

Lecturer: Førsteamanuensis Torbjørn Ekman
Weekly hours: Autumn: 4F+4Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE2040: 7.5 Cr
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course gives an introduction in radio technology with importance for communication systems based on the use of radio waves. It is also an introduction to the design of important radio systems for broadcasting fixed and mobile services.
Recommended previous knowledge: Based on the third year of the program Electronics, or equivalent. The courses TMA4120/35 Calculus 4K/4D and TMA4245 Statistics, or equivalent.
Academic content: Generic radio technology, wave propagation, noise, modulation. Multiple access techniques with emphasis on Code Division Multiple Access (CDMA), which is used in third generation cellular telecommunication systems. Application of coding. Basic traffic theory. The design of important systems for radio communication with emphasis on broadcasting, fixed radio links and mobile communications. The focus is on the three lowest layers of the OSI-model. Technical specifications of communication systems as well as regulations and standards will also be covered.

Teaching methods and activities: Lectures, compulsory homework problems and computer exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: The course material is announced at the first lecture.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4150 NAVIGASJONSSYSTEMER
Navigasjonssystemer
Navigation Systems

Lecturer: Professor Børje Forssell
Weekly hours: Spring: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE2050: 7.5 Cr
Grade: Letter grade Compulsory assignments: None

Learning objectives: To familiarise the students with principles and requirements in electronics, signal processing, wave propagation and system technology fundamental to the design and use of navigation systems, as well as with the functions and performance of existing and planned navigation systems.
Recommended previous knowledge: Knowledge of electrical engineering fundamentals, mathematics, statistics and fundamentals of electronics, corresponding to a B.Sc. in electrical and electronics engineering. Signal processing, antennae, microwave techniques, wave propagation.
Academic content: Wave propagation along the surface of the earth and in the atmosphere, hyperbolic navigation, terrestrial and satellite-based navigation systems as LORAN-C, radio beacons, GPS, GLONASS, GALILEO, aircraft navigation systems, inertial navigation, and radar principles and methods.
Teaching methods and activities: Lectures, exercises and equipment demonstrations. The exercises consist of 10 problems with solutions, all accessible via the web site of the Department. The course can be held in English if international students attend. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: B. Forssell: Radionavigation Systems, Prentice Hall, 1991, (reproduced by Tapir). Texts about radar published by the Department of Telecommunications, journal articles.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4155 FJERNMÅLING
Fjernmåling
Remote Sensing

Lecturer: Professor II Jens F. Hjelmstad
Weekly hours: Autumn: 3F+2Ø+7S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE2055: 7.5 Cr
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course gives the student an introduction to the use of electromagnetic waves for remote sensing and an overview of existing and future systems, with a focus on satellite systems.
Recommended previous knowledge: General knowledge of physics and electronics essential, specialised knowledge in microwave systems, electrooptics, laser systems, satellite design, digital signal processing and detection theory an advantage, but no prerequisite. NTNU subjects TFE4130 Electromagnetic and Acoustic Waves, TTT4120 Digital Signal Processing and TFE4160 Electro Optics are relevant, but not compulsory.
Academic content: Basic properties of electromagnetic waves. Scattering and interection of electromagnetic waves with gases and solid materials in optical, IR and microwave bands. Principles of remote sensing instruments, such as imager, radiometer, scatterometer, lidar, radar, synthetic aperture radar, altimeters. Present and future satellite surveillance systems.
Teaching methods and activities: Postponed/repeated exams may be oral.
Course materials: Books, compendium
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4160 MOBILKOMMUNIKASJON
Mobilkommunikasjon
Mobile Communicatons

Lecturer: Professor Geir Egil Øien
Weekly hours: Spring: 3F+2Ø+7S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English, Norwegian
SP-reduksjon: SIE2075: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course gives an introduction in mobile communication systems with emphases on the Physical Layer and associated signal processing, propagation, propagation and important elements of the Medium Access Control (MAC) Layer.
Recommended previous knowledge: The background for TTT4160 Mobile Communication are basic course in Communications theory like TTT4115 and basic knowledge of digital signal processing like TTT4120. It is also an advantage to have a basic course in Digital Communications like TTT4130.
Academic content: A short introduction into mobile communications is given. The cellular concept is discussed. Multiplexing and duplexing methods are covered. Radio propagation is addressed and models for both large-scale and small-scale fading are presented. In this context an introduction into timevariant linear systems is given. Diversity principles are studied. Radio coverage and spectral efficiency of mobile communication systems are analyzed. A major part of the course is devoted to the physical layer of radio transmission techniques, such as modulation, coding, interleaving, and equalisation. As an example of a mobile communication system, the Global System for Mobile Communications (GSM) is presented and studied. Finally, the concept of mobile ad-hoc networks is introduced.
Teaching methods and activities: Lectures and exercises. If the exam is failed, the written exam may be replaced by an oral exam.
Course materials: Andrea Goldsmith: Wireless Communications, Cambridge Univ. Press, 2005.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4170 AUDIOTEKNOLOGI
Audioteknologi
Audio Technology

Lecturer: Professor Peter Svensson
Weekly hours: Autumn: 4F+1Ø+7S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE2060: 7.5 Cr
Grade: Letter grade Compulsory assignments: Laboratory exercises

Learning objectives: The course gives fundamental insight into acoustic communication in audio systems and multimedia applications.
Recommended previous knowledge: Knowledge of mathematics, electrical circuits, and physics corresponding to the first two years of the Electronics program.
Academic content: Sound waves, propagation and radiation, hearing and psychoacoustics, foundations for perceptual coding of audio signals, transducers and techniques for sound recording and reproduction, electrical analogies for mechanical and acoustical analogies, room acoustics, acoustical measurement techniques.
Teaching methods and activities: Lectures, classroom exercises, obligatory laboratory exercises. The laboratory exercises account for 25% of the grade and the final exam accounts for 75% of the grade.
Course materials: Finalized at the start of the course.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	75/100	C
EXCERCISES		25/100	

TTT4175 MARIN AKUSTIKK
Marin akustikk
Marine Acoustics

Lecturer: Professor Hefeng Dong
Weekly hours: Autumn: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English
SP-reduksjon: SIE2065: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The objective is to give the foundation for the use of acoustical waves in water, starting with the development of the acoustic wave equation from basic principles. The emphasis is on sonar for localization and classification of objects, but also acoustics for communication and navigation underwater.
Required previous knowledge: None.
Recommended previous knowledge: Prerequisite knowledge:
General background in mathematics and physics. Some familiarity with wave propagation problems and signal analysis. No prior knowledge of acoustics required.
Academic content: The course covers reflection and transmission at interfaces, wave propagation methods such as ray tracing techniques and normal mode theory. The theories for echo formation of simple targets and reverberation from volume and surfaces are discussed and empirical values are presented and discussed. The course is problem-oriented with focus on applications for detection and localization of objects. In this his context the role and design considerations for the major system elements are discussed such as transmitter, receiver, antenna and transducer technology and signal processing algorithms.
Teaching methods and activities: Class room lectures and computer assignments. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Jens M. Hovem: Marine acoustics (In Press) Applied Research Laboratories, University of Texas, Austin, Texas, 2004, Chapter 1-11. The course material is available both in English and Norwegian.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	A

TTT4180 TEKNISK AKUSTIKK
Teknisk akustikk
Technical Acoustics

Lecturer: Professor Ulf R Kristiansen
Weekly hours: Spring: 3F+2Ø+7S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: SIE2085: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course shall give a theoretical and a practical insight into sound generation and propagation in open and closed systems. The applications will primarily be the analysis and konstruction of acoustic sources, acoustic treatment of rooms, and design of silent systems.
Recommended previous knowledge: Knowledge in mathematics and physics corresponding to 1st and 2nd year of the study program for electronics. Necessary basic acoustic theory will be given during the course.
Academic content: Field descriptions in the frequency and time domains. Visualization of acoustic fields. Sound propagation above ground. Influence of atmospheric conditions and physical boundaries. Room acoustics and sound propagation in wave guides. Idealized sound sources and radiation from vibrating plates and membranes. Musical instruments as sound sources. Coupling between vibrating structures and acoustic fields. Analytical and numerical solutions.
Teaching methods and activities: Lectures, obligatory and non obligatory exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Information will be given at the start of the course.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	B

TTT4185 TALETEKNOLOGI
Taleteknologi
Speech Technology

Lecturer: Professor Torbjørn Svendsen
Weekly hours: Spring: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE2090: 7.5 Cr
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The course aims at giving an understanding of basic properties of speech, speech production and perception as well as an insight in how this understanding can be applied for constructing systems for automatic speech recognition and speech synthesis.
Recommended previous knowledge: TTT4120 Digital Signal Processing or equivalent.
Academic content: Acoustic description of speech production. Digital models for production of speech. Physiology of the ear and hearing. What we hear and what we perceive: human perception of speech and sound. Linguistic and statistical description of the speech signal. Methods for speech analysis. Basic methods for statistical pattern recognition. Automatic speech recognition with emphasis on statistical methods (Hidden Markov Models): statistical methods for acoustic and linguistic modeling; principles for efficient decoding (recognition). Speech synthesis, speech concatenation and text-to-speech synthesis: Text analysis, prosodic modelling and sound synthesis.
Teaching methods and activities: Lectures, voluntary homework problems and mandatory group based computer excercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Text book will be announced at semester start.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TTT4190 MUSIKKTEKNOLOGI
Musikkteknologi
Music Technology

Lecturer: Amanuensis Jan Tro
Weekly hours: Spring: 3F+2Ø+7S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: SIE2095: 7.5 Cr
Grade: Letter grade Compulsory assignments: None

Learning objectives: This course gives basic knowledge for sound and music control and signal processing, emphasizing musical instruments as sound sources, computer assisted music production, processing and distribution.
Recommended previous knowledge: Basic knowledge in mathematics, physics and digital signal processing.
Academic content: Voice and music as signal, music informatics, acoustical and electronical music instruments, psycho acoustics, music psychology and perception, music analyses and syntheses, MIDI, music performance, sound media.
Teaching methods and activities: Lectures and laboratory exercises.
Course materials: Articles and book chapters.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TTT4195 MARIN OBSERVASJ TEKN
Marin observasjonsteknologi
Marine Observation Technology

Lecturer: Professor Jens Martin Hovem
Weekly hours: Autumn: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course should lead to a knowledge of the physical laws and principles fall types of systems for marine monitoring and also gives and overview over the applications of technology for observation of marine environment.
Academic content: The first part of the course reviews the relevant mathematics and physics required for the understanding of acoustic and electromagnetic wave propagation. This part will be adapted to the students‘s previous knowledge and requirements. Thereafter an overwiev of telecommunication systems is given and with descriptions of radar, sonar and lidar systems operated from various platforms such as satellites, aircraft, underwater vehicles and stationary observations systems. Focus is given on system for the assessment of biomass abundance, fish and plankton and systems for monitoring of oceanographic parameters. Other central themes are systems for navigation and positing and systems for data communication in air using radio

waves and underwater using acoustic waves. Finally the course describes the principles for model based estimation and inversion and relevant examples are presented.
Teaching methods and activities: Lectures, class room exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Specified at the beginning of the course.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	A

TTT4200 RADIOTEKNIKK INTRO
Radioteknikk, introduksjon
Introduction to Radio Systems

Lecturer: Førsteamanuensis Kjell Olav Aamo
Weekly hours: Spring: 3F+5Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The subject will give a broad survey of components included in the "physical layer" of different wireless systems. The student will learn how signals propagate through the main components from "transmitter" to "receiver", and the way these components operate and cooperate. The course also gives the first introduction to analysis and design of selected system components.
Recommended previous knowledge: Knowledge in electrical engineering fundamentals like TET4100 Circuit Analysis and TTT4100 Electronic Circuits or equivalent.
Academic content: Wireless communication systems, radio waves, antennas, transmission lines, matching networks, receive- and transmit amplifiers, noise and distortion, oscillators, frequency- conversion and synthesis.
Teaching methods and activities: Lectures and exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: D.M. Pozar: Microwave and RF Design of Wireless Systems, John Wiley og Sons Inc, 2001.
Assessment: Written examination/Work

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	75/100	C
EXCERCISES		25/100	

TTT4205 MIKROBØLGE PASS KOMP
Mikrobølge og høyhastighets passive komponenter
Microwave and Highspeed Passive Components

Lecturer: Professor Guennadi Kouzaev
Weekly hours: Autumn: 4F+3Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Exercises

Learning objectives: The goal of this course is to give the students a basic knowledge on microwave and high-speed components which are important parts of contemporary electronics of the increased frequency and high-speed.
Recommended previous knowledge: Basic electromagnetics, circuit theory, vectorial algebra.
Academic content: This course is on passive components for microwave and high-speed electronics. The theory of microwaves and high-speed phenomena is given for transmission lines- waveguides, microstrip lines, slotlines, coplanar waveguides, etc . An essential part of this course is for basic discontinuities of transmission lines, integrated and lumped capacitors, inductors, resistors and based on them more complicated devices like filters, directional couplers, power dividers, etc. It is given basic knowledge on the contemporary integrated technologies and CAD of integrated microwave and high-speed circuits.
Teaching methods and activities: Lectures and exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: K.R. Demarest "Engineering Electromagnetic" Prentice-Hall Int., 1998. J. Edminster, "Electromagnetics" McGraw-Hill, 2003. "Problems and Solutions on Electromagnetism" Ed. L.Yung-kuo,World Scientific, 1993.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TTT4210 MIKROBØLGE INT KRETS
Mikrobølge integrerte kretser
Microwave Integrated Circuits

Lecturer: Førsteamanuensis Kjell Olav Aamo, Førsteamanuensis Morten Olavsbråten
Coordinator: Førsteamanuensis Morten Olavsbråten
Weekly hours: Spring: 3F+5Ø+4S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Exercise

Learning objectives: This course will give fundamental understanding of crucial components in radio systems for e.g. communications, radar and navigation, and give knowledge on analysis, design and technology of such circuits. Further familiarise the students with CAD and measurement techniques to be able to design selected circuits for the frequency range 50MHz to 50GHz, and make laboratoty tests.
Recommended previous knowledge: Knowledge of electrical circuit and system fundamentals like TET4100 Circuit Analysis, TTT4100 Electronic Circuits and TTT4200 Introduction to Radio Systems or equivalent courses.
Academic content: Microwave transistors with model and S-parameter descriptions, stability, design of amplifiers and oscillators with emphasis on noise and non-linear characteristics, hybrid-and monolithic integrated circuits, CAD and measurement techniques.
Teaching methods and activities: Lectures, calculus-CAD -and laboratory exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Given at the start of the course.
Assessment: Written examination/Work

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	80/100	C
EXCERCISES		20/100	

TTT4215 ANTENNETEKNIKK
Antenneteknikk
Antenna Engineering

Lecturer: NN
Weekly hours: Spring: 3F+4Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Exercise

Learning objectives: One should understand the fundamental radiation mechanisms and from that understand the specific properties of the antenna types treated. One should also achieve a good design background for building such antennas.
Recommended previous knowledge: TFE4120 Electromagnetics and TTT4200 Radio Engineering, Introduction or corresponding knowledge.
Academic content: Fundamental antenna properties. Radiation from general current sources in free space. Array antennas. Analysis of some important types like electrically small antennas, resonant antennas, broadband antennas, and aperture antennas including reflector antennas. The method of moments for computing the current distribution on wire antennas.
Teaching methods and activities: Lectures. Compulsary computer and laboratory exercises. Optional problem exercises. In case of continuation, the written exam may be changed to oral exam.
Course materials: Given at the start of the course.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TTT4220 SATELLITTKOMMUNIK
Satellittkommunikasjon
Satellite Communications

Lecturer: Professor Odd Gutteberg
Weekly hours: Spring: 3F+4Ø+5S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Learning objectives: Course objective: The course oulines the fundamental principals of satellite communications, as seen from a system perspective. The course teaches skills that will enable the students to analyze and dimension satellite communication systems.
Recommended previous knowledge: Recommended prerequisites: The course is based on knowledge equal to the the 3rd year of the study programme "Electronics", or similar.

Academic content: Course content: This course presents the fundamental aspects of satellite communications. The following topics will be covered: orbital mechanics, launching of satellites, satellite technology (different subsystems), the space link, transmission theory, radio propagation, tropospheric influence, interference, link-budgets, noise, modulation, multiple access methods, coding, earth station technology, system considerations (broadcasting, mobile- and fixed services).
Teaching methods and activities: Educational activities: Lectures and exercises(optional). Resit examination may be altered from written to oral.
Course materials: Information about course material will be given at the opening of semester.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TTT4225 ANV SIGNALBEHANDLING
Anvendt signalbehandling
Applied Signal Processing

Lecturer: Førsteamanuensis Lars Magne Lundheim
Coordinator: Førsteamanuensis Magne Hallstein Johnsen
Weekly hours: Spring: 2F+2Ø+8S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Learning objectives: Learn to use signal processing tools and algorithms in order to implement common moduls applied to real signals. Learn to design complete systems by compiling modules. Learn a typical complete development process from idea to a tested system. Learn to document the student work by writing a final report.
Recommended previous knowledge: TTT4120 Digital Signal Procesing or equivalent knowledge.
Academic content: Common signal processing methods include a) filter analysis, design and structures, b) frequency-transformations, c) multirate-systems, d) correlation and frequency spectrum, e) modeling and estimation of real-world stochastic processes.
In this course the focus is on implementation of both single methods and systems based on these methods. The implementations will be based on high-level programming (i.e. C, C++, Matlab)and a realtime version on a signal processor including assembly-programming.
Teaching methods and activities: The course consists of a set of module-tasks, each based on a real-world signal and several methods. Each module starts with introductory lectures, after which the students shall fulfil the task groupwise. In addition, each group shall implement a system based on several modules. Systems and modules will be chosen from speech- or image-processing, digital communication, aso. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Lecture notes, programming manuals, aso.
Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	50/100	D
EXCERCISES		50/100	

TTT4230 AKUSTIKK INTRO
Akustikk, introduksjon
Introduction to Acoustics

Lecturer: Professor Ulf R Kristiansen
Weekly hours: Spring: 4F+2Ø+6S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: Laboratory exercises

Learning objectives: The course should lead to a knowledge of the physical laws and principles for the generation and propagation of sound in air and in water. The course also gives an overview over the major applications and areas where knowledge of acoustics is necessary. These include recording and reproduction of music and speech, technical acoustics and systems for communication, classification and detection under water, as well as propagation and reduction of noise.
Recommended previous knowledge: Knowledge of mathematics, physics and basic signal processing corresponding to the first two years of the Electronics program. The course is an introduction into acoustics for students who intend to continue with the more specialised courses TTT4170 Audio Technology, TTT4175 Marine Acoustics, TTT4180 Technical Acoustics, or TTT4190 Music Technology. The course is also intended for those who want a general introduction into acoustics, without any further specialisation.
Academic content: Acoustical waves, the wave equation and its' solutions in open and closed spaces. Acoustical sources, propagation in air and under water. Acoustical measurement techniques and signal processing. Techniques for sound recording and sound reproduction of music and speech, description of music instruments. The anatomy of the ear, hearing and perception of sound. Introduction into sonar systems for the detection of fish and other objects under water, and into wireless underwater communication.

Teaching methods and activities: Lectures, class room exercises, obligatory laboratory exercises. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Selected parts from: L. E. Kinsler, A. R. Frey, A. B. Coppens, and J. V. Sanders. Fundamentals of acoustics, 4th ed. John Wiley Sons, New York City, 2000. Supplementary papers.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	A

TTT4510 DIG KOMM FDP
Digital kommunikasjon, fordypningsprosjekt
Digital Communications, Specialization Project

Lecturer: Professor Geir Egil Øien
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English, Norwegian
SP-reduksjon: TTT4710: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization projects in signal processing in medical applications.
Recommended previous knowledge: For students in the study programmes Electronics and Communications Technology with main profile Signal Processing in Medical Applications.
Academic content: The course is designed to equip the student with in-depth knowledge within a selected topic within the field of digital communications, by means of the realization of a scientific project. As a main rule the project work is to be done by individual students, but can also be done within smaller groups if this is deemed worthwhile. The topic is chosen after discussion with a professor, from a list of currently available topics within the field of digital communications,. Typical applications for projects are at present within wireless and mobile communications, satellite communications, digital subscriber line systems, and signal processing and communications in wireless sensor networks. Typical topics within these fields are e.g. multiple access and modulation methods, dynamic resource allocation in communication networks, performance analysis and system modeling, novel standards for wireless and wired communication systems, channel modelling and measurements, spectrum use and capacity analysis, source and channel coding, energy-efficient protocols in short-range radio communications, cognitive radio, and ultrawideband systems. The outcome of the work, which typically combines theory and literature studies with simulations and possibly implementation work, is a written project report as well an oral presentation of the project.
Teaching methods and activities: Individual projects with supervision.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TTT4515 DIG KOMM FDE
Digital kommunikasjon, fordypningsemne
Digital Communications, Specialization Course

Lecturer: Professor Geir Egil Øien
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English, Norwegian
SP-reduksjon: TTT4710: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization knowledge in signal processing in medical applications.
Recommended previous knowledge: For students in the study programmes Electronics and Communications Technology with main profile Signal Processing in Medical Applications.
Academic content: The student shall choose two elective themes of 3,75 stp each or one elective theme of 7,5 stp. Possible themes are: Biomedical Image and Signal Processing and Communications, Digital Image Communication (3,75 stp), Communication and Coding Theory for Wireless Channels (3,75 stp), Signal Processing Techniques in Ultrasound Imaging - (3,75 stp), Statistical Signal Processing in Ultrasound Imaging - (3,75 stp), Ultrasound Transducers and Frontend Technology for Ultrasound Imaging - (3,75 stp), Medical Instrumentation - (3,75 stp), Acoustics Remote Sensing - (3,75 stp), Radar - (3,75 stp), Medical Sensors - (3,75 stp), Adaptive Filtering - (3,75 stp), Fusion of Sensor Data and Advanced Radar Concepts - (3,75 stp), 3D-Sound and Sound in Multimedia Applications - (3,75 stp).
Teaching methods and activities: The elective themes can be taught through lectures, seminars and self studies. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Will be announced at the beginning of the semester.

Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4520 SIGN BEH MED ANV FDP
Signalbehandling i medisinske anvendelser, fordypningsprosjekt
Signal Processing in Medical Applications, Specialization Project

Lecturer: Førsteamanuensis II Ilangko Balasingham
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English, Norwegian
SP-reduksjon: TTT4725: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization projects in signal processing in medical applications.
The student shall make an in-depth study of a theme using scientific work methods. This involves the search for completing material through litterature surveys and combining results from such with personal knowledge. The student shall learn to carry out a larger independent project. This includes project planning, reporting milestone results, and writing a final project report.
Recommended previous knowledge: For students in the study programmes Electronics and Communications Technology with main profile Signal Processing in Medical Applications.
Academic content: Technology development for novel algorithms and systems that find applications in medicine. The project can be modified depending on interest.
Teaching methods and activities: Individual projects with supervision.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TTT4525 SIGN BEH MED ANV FDE
Signalbehandling i medisinske anvendelser, fordypningsemne
Signal Processing in Medical Applications, Specialization Course

Lecturer: Førsteamanuensis II Ilangko Balasingham
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: English, Norwegian
SP-reduksjon: TTT4725: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization knowledge in signal processing in medical applications.
Recommended previous knowledge: For students in the study programmes Electronics and Communications Technology with main profile Signal Processing in Medical Applications.
Academic content: The student shall choose two elective themes of 3,75 stp each or one elective theme of 7,5 stp. Possible themes are: Biomedical Image and Signal Processing and Communications, Digital Image Communication (3,75 stp), Communication and Coding Theory for Wireless Channels (3,75 stp), Signal Processing Techniques in Ultrasound Imaging - (3,75 stp), Statistical Signal Processing in Ultrasound Imaging - (3,75 stp), Ultrasound Transducers and Frontend Technology for Ultrasound Imaging - (3,75 stp), Medical Instrumentation - (3,75 stp), Acoustics Remote Sensing - (3,75 stp), Radar - (3,75 stp), Medical Sensors - (3,75 stp), Adaptive Filtering - (3,75 stp), Fusion of Sensor Data and Advanced Radar Concepts - (3,75 stp), 3D-Sound and Sound in Multimedia Applications - (3,75 stp).
Teaching methods and activities: The elective themes can be taught through lectures, seminars and self studies. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Will be announced at the beginning of the semester.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4530 ROMTEKN/NAVIG FDP
Romteknologi og navigasjon, fordypningsprosjekt
Space Technology and Navigation, Specialization Project

Lecturer: Professor Børje Forssell, Professor Odd Gutteberg, Professor II Jens F. Hjelmstad
Coordinator: Professor Odd Gutteberg

Weekly hours: Autumn: 24S = 15.0 Cr
Time: Not lectured in study year 2007-2008
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: None

Teaching methods and activities: Individual projects with supervision.
Course materials: Announced at course start.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TTT4535 ROMTEKN/NAVIG FDE
Romteknologi og navigasjon, fordypningsemne
Space Technology and Navigation, Specialization Course
Lecturer: Professor Børje Forssell, Professor Odd Gutteberg, Professor II Jens F. Hjelmstad
Coordinator: Professor Børje Forssell
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Not lectured in study year 2007-2008
Lang. of instruction: Norwegian
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course provides specialization in Space Technology, Radar and Navigation Systems, and Remote Sensing.
Recommended previous knowledge: One or more of the courses: TTT4220 Satellite Communications, TTT4140 Fundamentals of Navigation, TTT4155 Remote Sensing, TTT4175 Marine Acoustics, TTT4150 Navigation Systems.
Academic content: This specialization course encompasses two electives. Topics of specialization:
- Satellite Navigation.
- Satellite Communication.
- Radar.
- Acoustic Remote Sensing.
- Sensor Data and Advanced Radar Consepts.

Teaching methods and activities: Lectures, self study, seminars. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Announced at course start.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TTT4540 RADIOTEKN/KOMM FDP
Radioteknikk og -kommunikasjon, fordypningsprosjekt
Radio Systems and Communication, Specialization Project
Lecturer: Førsteamanuensis Jon Anders Langen Aas, Førsteamanuensis Torbjørn Ekman, Professor Odd Gutteberg, Professor Guennadi Kouzaev, Førsteamanuensis Morten Olavsbråten
Coordinator: Professor Odd Gutteberg
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4720: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Teaching methods and activities: Individual projects with supervision.
Course materials: Announced at course start.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TTT4545 RADIOTEKN/KOMM FDE
Radioteknikk og -kommunikasjon, fordypningsemne
Radio Systems and Communication, Specialization Course
Lecturer: Førsteamanuensis Jon Anders Langen Aas, Førsteamanuensis Torbjørn Ekman, Professor Odd Gutteberg, Professor Guennadi Kouzaev, Førsteamanuensis Morten Olavsbråten
Coordinator: Førsteamanuensis Torbjørn Ekman

Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4720: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course provides specialization in radio systems, design and communication.
Recommended previous knowledge: One or more of the courses: TTT4145 Radio Communications, TTT4205 Microwave and Highspeed Passive Components, TTT4210 Microwave Integrated Circuits, TTT4215 Antenna Engineering, TTT4220 Satellite Communications.
Academic content: This specialization course encompasses two electives. Topics of specialization:
- Satellite Communication.
- Antennas.
- Passive Microwave Components.
- Active Microwave Integrated Circuits.

Teaching methods and activities: Lectures, self study, seminars. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Announced at course start.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TTT4550 AKUSTIKK FDP
Akustikk, fordypningsprosjekt
Acoustics, Specialization Project

Lecturer: Professor Ulf R Kristiansen
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
SP-reduksjon: TTT4700: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: The student shall make an in-depth study of an acoustic theme using scientific work methods. This involves the search for completing material through litterature surveys and combining results from such with personal knowledge. The student shall learn to carry out a larger independent project. This includes project planning, reporting milestone results, and writing a final project report.
Recommended previous knowledge: For students in Electronics majoring in Acoustics.
Academic content: Technology for converting electromagnetic waves to acoustic and acoustic waves to electromagnetic (loudspeakers and microphones), computer assisted sound generation (virtual sound sources). The applications comprise. Acoustic waves for communication and remote sensing in marine environments. Sound as an environmental factor- noise abatement. Audio technology and subjective perseption of sound.
Teaching methods and activities: Individual projects with supervision.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TTT4555 AKUSTIKK FDE
Akustikk, fordypningsemne
Acoustics, Specialization Course

Lecturer: Professor Ulf R Kristiansen
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4700: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Recommended previous knowledge: For students in Electronics majoring in Acoustics.
Academic content: Technology for converting electromagnetic waves to acoustic and acoustic waves to electromagnetic (loudspeakers and microphones), computer assisted sound generation (virtual sound sources). The applications comprise. Acoustic waves for communication and remote sensing in marine environments. Sound as an environmental factor- noise abatement. Audio technology and subjective perseption of sound. Two themes shall be chosen from the list: Acoustic remote sensing (3.75 stp), Music and sensation (3.75 stp), 3-D sound and sound in multimedia applications (3.75 stp), Numerical acoustics: selected

topics (3.75 stp), Effects of sound (3.75 stp), Building acoustics: sound insulation (3.75 stp), Building acoustics: room acoustics (3.75 stp).
Teaching methods and activities: In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Will be detailed at start of course.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4560 MULTIMEDIA SIGN FDP
Multimediasignalbehandling, fordypningsprosjekt
Multimedia Signal Processing, Specialization Project

Lecturer: Professor Torbjørn Svendsen
Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4705: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization projects in communication with sound, images and video including human-machine interaction through different communication channels.
Recommended previous knowledge: For students in the study programmes Electronics and Communications Technology with main profile Multimedia Signal Processing.
Teaching methods and activities: Individual projects with supervision. The project shall be documented by a written report and an oral presentation.
Course materials: To be announced.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TTT4565 MULTIMEDIA SIGN FDE
Multimediasignalbehandling, fordypningsemne
Multimedia Signal Processing, Specialization Course

Lecturer: Professor Torbjørn Svendsen
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4705: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: Specialization knowledge in communication with sound, images and video including human-machine interaction through different communication channels.
Recommended previous knowledge: For students in the study programmes Electronics and Communications Technology with main profile Multimedia Signal Processing.
Academic content: The student shall choose two elective themes of 3,75 stp each or one elective theme of 7,5 stp. Possible themes are: TTT1 3D-Sound and Sound in Multimedia applications (3,75 stp); TTT5 Digital Image Communication (3,75 stp); TTT9 Communication and Coding Theory for Wireless Channels (3,75 stp); TTT11 Music and Perception (3,75stp), TTT16 Speech Technology, selected topics; TTT17 Effects of Sound (3,75stp).
Teaching methods and activities: The elective themes can be taught through lectures, seminars and self studies. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Will be announced at the beginning of the semester.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	D

TTT4570 NAV/FJERNMÅL FDP
Navigasjon og fjernmåling, fordypningsprosjekt
Navigation and Remote Sensing, Specialization Project

Lecturer: Professor Børje Forssell, Professor Odd Gutteberg, Professor II Jens F. Hjelmstad
Coordinator: Professor Odd Gutteberg

Weekly hours: Autumn: 24S = 15.0 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4715: 15.0 SP
Grade: Letter grade Compulsory assignments: None

Teaching methods and activities: Individual projects with supervision.
Course materials: Announced at course start.
Assessment: Work

Forms of assessment	Date/Time	Percentage	Exam. support
EXCERCISES		100/100	

TTT4575 NAV/FJERNMÅL FDE
Navigasjon og fjernmåling, fordypningsemne
Navigation and Remote Sensing, Specialization Course

Lecturer: Professor Børje Forssell, Professor Odd Gutteberg, Professor II Jens F. Hjelmstad
Coordinator: Professor Børje Forssell
Weekly hours: Autumn: 12S = 7.5 Cr
Time: Teaching time and location will be announced on the web.
Lang. of instruction: Norwegian
SP-reduksjon: TTT4715: 7.5 SP
Grade: Letter grade Compulsory assignments: None

Learning objectives: The course provides specialization in Space Technology, Radar and Navigation Systems, and Remote Sensing.
Recommended previous knowledge: One or more of the courses: TTT4220 Satellite Communications, TTT4140 Fundamentals of Navigation, TTT4155 Remote Sensing, TTT4175 Marine Acoustics, TTT4150 Navigation Systems.
Academic content: This specialization course encompasses two electives. Topics of specialization: - Satellite Navigation - Satellite Communication - Radar - Acoustic Remote Sensing - Sensor Data and Advanced Radar Consepts.
Teaching methods and activities: Lectures, self study, seminars. In case of continuation exams, these will be arranged before the end of the same exam period. If there is a re-sit examination, the examination form may be changed from written to oral.
Course materials: Announced at course start.
Assessment: Written examination

Forms of assessment	Date/Time	Percentage	Exam. support
WRITTEN	Kunngjøres på nett	100/100	C

TTT4900 AKUST SIGN BEH KOMM
Akustikk, signalbehandling og kommunikasjon, masteroppgave
Acoustics, Signal Processing and Communication, Master Thesis

Lecturer: NN
Weekly hours: Spring: = 30.0 Cr
Time: Not lectured in study year 2007-2008
Grade: Letter grade Compulsory assignments: None

Assessment: Thesis

Forms of assessment	Date/Time	Percentage	Exam. support

TTT4905 RADIOSYSTEMER
Radiosystemer, masteroppgave
Radio Systems, Master Thesis

Lecturer: NN
Weekly hours: Spring: = 30.0 Cr
Time: Teaching time and location will be announced on the web.
Grade: Letter grade Compulsory assignments: None

Assessment: Thesis

Forms of assessment	Date/Time	Percentage	Exam. support