COURSE DESCRIPTIONS

EEE DEPARTMENT FIRST CYCLE COURSE DESCRIPTIONS

(2014)

First year

Mandatory courses

MTH103. Linear algebra
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
The course begins with an introduction to matrices, fields and vector spaces, linear transformations, change of basis. Concrete examples are given through linear equations, existence and classification of solutions, Gaussian elimination and LU decomposition. Characteristic equation of a matrix, finding eigenvalues, eigenvectors and the Jordan form are done through exercises, as well as numerical techniques for computing eigenvalues and eigenvectors. Inner product spaces, quadratic form are covered as well.

CEN111. Programming I
Hours (Theoretical-Practical): 5 (3-2) ECTS: 6
The objective of this course is to equip the students with the basic understanding of algorithms and programming concepts. Flowcharts are also covered in the course.

ELT117. Advanced reading and writing I
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
The course reinforces academic reading skills (finding the main idea, skimming, scanning, inferring information, guessing vocabulary from context, etc.) through reading selections on a variety of topics. It also aims at developing critical thinking, which enables students to respond to ideas in a well-organized written format. Other reading related writing skills such as paraphrasing and summarizing are also dealt with.

PHY 101. General physics I
Hours (Theoretical-Practical): 5 (3-2) ECTS: 6
In this part of physics course, treatise starts with vectors, kinematics, Newton's laws of motion. Concepts of work and energy, conservation of energy, linear momentum and its conservation are introduced, as well as rotation of rigid bodies about a fixed axis, angular momentum and its conservation.

MTH101. Calculus I
Hours (Theoretical-Practical): 5 (3-2) ECTS: 6
Functions, Limits, continuity and derivatives are introduced, together with applications. Extreme values, the Mean Value Theorem and its applications, graphing follow, together with the definite integral, area and volume as integrals, the indefinite integral. Finally, topics like transcendental functions and their derivatives, L'Hopital's rule, techniques of integration, improper integrals and their applications, parametric curves, polar coordinates are covered.

BOS101. Bosnian language I
Hours (Theoretical-Practical): 2 (2-0) ECTS: 2
This course is taught through the Bosnian Language. The course contains basic grammatical rules of the language. Everyday practical use of the language. This course is for Turkish students.

TDE191. Turkish language I

Hours (Theoretical-Practical): 2 (2-0) **ECTS: 2**
This course is taught through the Turkish Language. The course contains basic grammatical rules of the language. Everyday practical use of the language. This course is for non-Turkish students.

EEE102. Introduction to electrical engineering
Hours (Theoretical-Practical): 4 (2-2) **ECTS: 6**
This course introduces students to the basic fundamentals of electrical engineering. Students will gain knowledge and understanding of basic DC and AC circuit theory, electronic devices and components, and digital and analog electronics. In addition, students will gain experience concerning the electrical engineering sections of the fundamentals of engineering exam.

ELT118. Advanced reading and writing
Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**
The course reinforces academic writing skills. In this course students write different types of essays based on the ideas they are exposed to in the reading selections. The emphasis is on the writing process in which students go through many stages from brainstorming and outlining to producing a complete documented piece of writing.

PHY102. General physics II
Hours (Theoretical-Practical): 5 (3-2) **ECTS: 6**
In this part of the course, equilibrium of rigid bodies, oscillations, gravitation, fluid statics and dynamics are analyzed, together with waves in elastic media, introduction to thermodynamics and kinetic theory, sound.

MTH102. Calculus II
Hours (Theoretical-Practical): 5 (3-2) **ECTS: 6**
This part of calculus course starts with infinite series, power series, Taylor series, followed by vectors, lines and planes in space. Another important topic in this course are the functions of several variables: limit, continuity, partial derivatives, the chain rule, directional derivatives, tangent plane approximation and differentials, extreme values, Lagrange multipliers. Double and triple integrals with applications and line integrals are covered as well.

MTH104. Probability and statistics for engineers
Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**
This course starts with descriptive statistics, sets, events, and probability. After introduction of random variables, discrete and continuous distributions, mathematical expectation and correlation analysis, discrete probability and popular distributions, Poisson process are presented. Important topics covered also include continuous probability distributions, introduction to reliability theory and failure, functions of random variables, introduction to estimation theory, simple and multiple regression and correlation, least squares. Scientific elements of statistics of extreme events, testing of hypothesis and engineering applications are included.

BOS102. Bosnian language II
Hours (Theoretical-Practical): 2 (2-0) **ECTS: 2**
This course is taught through the Bosnian Language. The course contains basic grammatical rules of the language. Everyday practical use of the language. This course is for Turkish students.

TDE192. Turkish language II
Hours (Theoretical-Practical): 2 (2-0) **ECTS: 2**

This course is taught through the Turkish Language. The course contains basic grammatical rules of the language. Everyday practical use of the language. This course is for non-Turkish students.

Second year

Mandatory courses

EEE201. Circuit theory I
Hours (Theoretical-Practical): 5 (3-2) ECTS: 6
This course introduces circuit variables, followed by circuit elements and mathematical models. Analysis starts from simple resistive circuits, continuing with multi-terminal and multi-port algebraic components. Techniques of general circuit analysis are introduces, and once reactive components are included, first and second order RLC circuits are analyzed.

EEE203. Electromagnetic field theory
Hours (Theoretical-Practical): 4 (2-2) ECTS: 4
After revision of vector analysis, electrostatic and magnetostatic forces and fields in vacuum and in material bodies, this course focuses on energy and potential, steady electric current and conductors. Dielectric properties of materials are studied, as wells as boundary conditions for electrostatic and magnetostatic fields. Poisson's and Laplace's Equations are thoroughly analyzed, and magnetic circuits and inductance are introduced.

EEE283. Digital design
Hours (Theoretical-Practical): 5 (3-2) ECTS: 6
This course introduces Boolean algebra, number systems, data representation, logic theorems, canonical forms, simplification techniques and logic gates. Based on these fundamentals, students may start with the design of combinational circuits, timing and timing problems, sequential circuits, design of sequential circuits and the algorithmic state machine, programmable logic devices, register operations, basic computer organization and design.

MTH201. Differential equations
Hours (Theoretical-Practical): 4 (2-2) ECTS: 4
This course covers first-order differential equations, second-order linear equations, Wronskian, change of parameters, homogeneous and non-homogeneous equations. Additional techniques include series solutions, Laplace transform, systems of first-order linear equations, boundary value problems, Fourier series.

EEE205. Semiconductor devices and modeling
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course reviews semiconductor physics. p-n junction devices. Phenomena covered include tunnel diode and impact avalanche transit-time. Based on the properties learned before, junction transistor, metal-semiconductor devices, metal-insulator-semiconductor devices, surface field effect and optoelectronic devices, as well as semiconductor lasers are introduced. Processes in IC fabrication such as epitaxial process, diffusion, oxidation, ion implantation, metallization are discussed.

EEE202. Circuit theory II
Hours (Theoretical-Practical): 5 (3-2) ECTS: 6
This part of the circuit theory course starts with sinusoidal steady-state analysis and three-phase circuits. Laplace transform and its use in circuit analysis is described. Transfer function; gain and phase characteristics, filters. Fourier series and its applications to circuit analysis find their place as well.

EEE204. Electromagnetic wave theory
Hours (Theoretical-Practical): 4 (2-2) ECTS: 4
This part of electromagnetic theory course starts with wave equations and modelling of aerial lines and cables. What follows is modal analysis of transmission lines and power line carrier communications. Mode coupling as well as solution of transmission line transients using lattice, Fourier transform and time domain methods are also covered within the course.

EEE212. Signals and systems
Hours (Theoretical-Practical): 5 (3-2) ECTS: 6
This course deals first with continuous-time signals and systems, namely continuous-time LTI systems, Fourier transform and its applications. State variables for continuous-time systems are introduced. Second, discrete-time signals and systems, discrete-time LTI systems with the z-transform and its applications are introduced. State variables for discrete-time systems are finally introduced.

MTH204. Numerical analysis
Hours (Theoretical-Practical): 4 (2-2) ECTS: 4
This course introduces numerical solutions of nonlinear equations in terms of Newton's method, fixed points and functional iterations. At this point, it also covers LU factorization, pivoting, norms, analysis of errors. Orthogonal factorization and least square problems, polynomial interpolation, spline interpolation enable students to interpolate data, but also do numerical differentiation, Richardson extrapolation, numerical integration, Gaussian quadrature, error analysis.

EEE206. Electronics I
Hours (Theoretical-Practical): 5 (3-2) ECTS: 5
This course revises conduction mechanism in metals and semi-conductors; doping in semi-conductors; p-n junction; Diode characteristics and applications are revised as well, principle of power supplies functioning and bipolar junction. Transistor operation is a central point, together with transistor characteristic; transistor biasing; small-signal modeling and analysis; JFET operation and biasing, MOSFET operation and biasing; FET small-signal modeling and analysis. Thyristors and related devices are also covered.

Third year

Mandatory courses

EEE390. Internship
Hours (Theoretical-Practical): 5 (0-5) ECTS: 5
This course introduces students with real and industrial sector. Students must complete a 30 business-day (6 weeks) summer practice in a company that works with electric and electronics. Students are expected to learn about a real business and work environment and get involved in many aspects of hardware development process. Observations from industrial training must be documented and presented in the form of a clear and concise technical report.

CEN382. Microprocessors and microcomputing
Hours (Theoretical-Practical): 5 (3-2) ECTS: 5
This course provides an introduction to microprocessors. It presents introduction to computer and microprocessor architecture, addressing modes. In this course, arithmetic, logic and program control instructions. Programming microprocessor, 8086/8088 hardware specifications, interrupts, memory and basic I/O interface are covered. It uses C language to develop a foundation on the hardware, which executes a program. It is heavily based around the ARM 32-bit RISC microprocessor, a world-leading processor for power-

sensitive applications, and covers many aspects of designing power-efficient systems around ARM cores. It focuses on Memory and I/O interface design and programming, study of microprocessor and its basic support components including CPU architecture, memory interfaces, bus concepts, serial I/O devices, and interrupt control devices. Laboratories directly related to microprocessor functions and its interfaces.

EEE311. Electronics II
Hours (Theoretical-Practical): 5 (3-2) ECTS: 5
This course presents multistage amplifiers; coupling techniques and frequency response; differential amplifiers; high-frequency modeling of transistors, feedback and broadbanding techniques. Analog Integrated Circuits; OpAmp; power amplifiers; filters and oscillators; regulated power supplies are presented in the second half of semester. This course also presents how to analyze a given circuit such as differential amplifier or a multistage amplifier for input/output impedances or gain, analyze a given BJT or MOS circuit to find low and high cut-off frequencies, how to analyze a given BJT or MOS feedback circuit, how to design a BJT and MOS amplifier with the given gain or impedance specifications, how to design a BJT and MOS amplifier with the given cut-off frequency specifications.

EEE382. Linear control systems
Hours (Theoretical-Practical): 5 (2-2) ECTS: 5
This course first starts with mathematical models of systems. Then, it introduces state variable models: Signal-flow graph state models. After this, this courses presents characteristics and performance of feedback control systems. The stability of linear feedback systems: The Routh-Hurwitz criterion, the root locus method is presented afterward. In the end, this course introduces frequency response methods: The Bode diagram and stability in the frequency domain: Nyquist criterion.

EEE392. Senior design project
Hours (Theoretical-Practical): 6 (0-6) ECTS: 5
An independent study under the supervision of an advisor: Research on exploring and defining a potential study area suitable for a senior design project. Identification of a specific problem from the selected study area in electrical and electronics engineering. Results from this study are documented and presented in the form of a design project proposal Design and implementation of the project proposed. Presentation of the results in both oral and written forms.

Elective courses (technical)

EEE312. Biomedical signals and instrumentation
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course presents fundamentals of medical instrumentation in terms of bioelectric signals, physiological transducers on the human side and recording systems and biomedical recorders, patient monitoring systems on the computer side. Arrhythmia and ambulatory monitoring instruments, fatal monitoring instruments and blood flow meters as examples of devices used are described.

EEE313. Fundamentals of biomedical engineering
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course starts with introduction to cell physiology: the neuron, synapses and the neural models, continuing with sources of bioelectrical potentials and theory of ECG, EEG, EMG and electrodes for bioelectric and related instrumentation. Topics also dealt with include physiology and measurement of neural, circulatory, respiratory and metabolic systems, phonocardiography, patient care and monitoring, telemetry.

EEE314. Electronic measurement and instrumentation

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course introduces units and principles of measurement, error of measurement, probability of error as the elementary terms in measurement. Electronic measurements and electronic measuring instruments: Instrument amplifiers, signal sources, oscilloscopes, digital frequency meters, digital voltmeters are theoretically and practically explained. High frequency and microwave measurement techniques represent a modern addition to the course.

EEE315. Introduction to medical imaging

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

A wide scope of methods are introduced in this course, starting with X-Ray imaging: Radiography/mammography, fluoroscopy, CT: Operational modes, the CT gantry, image reconstruction, spiral CT, special imaging techniques, image quality, image artifacts, radiation safety, quality control. MRI: Concepts of magnetic resonance, principles of magnetic resonance imaging, pulse sequences, measurement parameters and image contrast, additional sequence modifications, artifacts, motion artifact, reduction techniques, MR angiography, advanced imaging applications, MR spectroscopy, instrumentation, contrast agents, clinical protocols. PET Scan. Ultrasound scan: The nature of diagnostic ultrasound, ultrasound interaction with tissue, ultrasound power and intensity, the ultrasound beam, the ultrasound imager, doppler ultrasound, ultrasound image artifacts, ultrasound quality control, biologic effects of ultrasound. IR scan.

EEE316. Foundations of magnetic resonance imaging

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course covers the basic principles of Functional Magnetic Resonance Imaging (fMRI), including: The physical principles of signal generation in MRI, the relation of neuronal activity with the blood-oxygen-level-dependent (BOLD) signal. Main emphases of the course are techniques to conduct experiments investigating the functional activity of the nervous system, statistical analysis of the fMRI data.

EEE321. Microwave engineering

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course introduces microwave transmission, transmission lines and waveguides. Based on this concept, elements of microwave circuits, scattering parameters, microwave resonators. microwave using ferrites are introduced. Another important topic is the generation and amplification of microwaves, klystrons, magnetrons, traveling wave tubes. Semiconductors in microwaves are explained.

EEE322. Antenna engineering

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

After a review of Maxwell's equations, electric and magnetic field, antenna-related topics such as radiation pattern, directivity, gain, matching techniques are introduced. Variants such as wire antennas, array antennas, aperture antennas, Huygens's principles, microstrip antennas, reflector, antenna design, smart antenna systems are explained thoroughly.

EEE324. Microwave electronics

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course introduces techniques of analog circuit technology in the gigahertz high-frequency regime. Transmission lines and distributed circuit elements; S-parameter design of high-frequency active circuits; computer-aided analysis and design are explained with emphasis on design of planar high-frequency integrated circuits employing CMOS and SiGe technology. Circuit building blocks for broadband wired and wireless communication will be emphasized including oscillators, low-noise amplifiers, and power amplifiers.

EEE331. Telecommunications I

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This is the first course in the series of two senior level courses on telecommunications aiming to introduce the basic principles behind the analysis and design of modern communication systems. The main goal of this course is to introduce the concepts of modulation and demodulation of information and the effect of noise on system performance. The topics that will be covered are spectral analysis of signals and systems, baseband representation of carrier modulated signals, random processes, continuous wave modulation (AM and FM) and their noise analysis, pulse modulation and baseband digital transmission.

EEE332. Telecommunications II

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

In this course, the basic concepts behind the design and analysis of digital communication systems will be introduced. Topics covered in class include sampling and quantization of analog information sources, digital pulse modulation techniques, signal space representation and analysis of digital signals, digital baseband modulation and demodulation, probability of error analysis, spectral shaping and intersymbol interference, digital bandpass transmission and error control coding.

EEE333. Digital Communication

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course introduces many important terms in digital communications: from random signals, bandwidth of digital data, character coding to Pulse Code Modulation, uniform and nonuniform quantization, correlative coding, detection of binary signals in Gaussian noise. Effects of intersymbol interference, equalization, coherent and noncoherent detection, error performance of binary systems, M-ary signaling and performance are investigated, as well as applicability of waveform coding, cyclic and block codes, types of error control, convolutional encoding and decoding algorithms.

EEE334. Digital signal processing

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course introduces algorithms for convolution and DFT linear prediction and optimum linear filters, least-squares methods for systems modeling and filter design. Thorough presentation of adaptive filters, recursive least-squares algorithms for array signal processing, QRD-based fast adaptive filter algorithms is given, as well as coverage of the standard Power Spectrum Estimation and signal analysis with Higher-Order Spectra.

EEE336. Communication electronics

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

Basic elements are introduced first, namely nonlinear controlled sources: piecewise linear, square-law, exponential and differential pair characteristics. Topics such as low level amplitude modulation and analog multiplication, followed by narrow band transformer as a coupler and nonlinear loading of tuned circuits enable understanding of physicality of communication. Tuned large signal amplifiers and frequency multipliers, phased locked loops, sinusoidal oscillators, frequency synthesizers explain the synchronicity in communication, together with mixers, modulators, and demodulators. Basic transmitters and receivers are explained and built.

EEE337. Introduction to wireless communications

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course will cover the basic topics in wireless communications. It begins with the overview of existing wireless systems and standards. Then, the characterization of the wireless channel is done through the analysis of its basic properties. Continuous and pulse modulations for wireless communication systems are presented and then, different diversity techniques in fading channels are introduced. Afterwards, some basics concerning the cellular communications and its development are presented. Last part of the course will be

devoted to the multi-user wireless communications and finally multiple antenna and space-time communications over wireless channels will be analyzed.

EEE346. Introduction to VLSI design
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
The beginning of the course deals with size and complexity of integrated circuits (IC), IC design process. Trends in very large scale integrated (VLSI) circuit design. IC production process. semiconductor processes are described in detail, followed by design rules and process parameters as well as layout techniques and practical considerations. Device modeling, circuit simulation. basic integrated circuit building blocks are shown practically and theoretically.

EEE348. Introduction to image processing
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course begins with the fundamentals of digital images, sampling and quantization of images. Simple manipulation in terms of arithmetic operations, gray scale manipulations, distance measures, connectivity is then introduced, followed by image transforms, enhancement, restoration, segmentation, representation and description.

EEE349. Introduction to optical fiber communications
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course is an introduction to optical communication systems, starting with optical fiber waveguides and transmission characteristics of optical fibers, cables and connections. As well as optical fiber measurements before proceeding with optical sources: Lasers, LEDs and detectors. Receiver noise considerations and optical fiber communication systems are added for discussion and practice.

EEE360. Illumination
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
After introducing basic light theories, eye, sensitivity and vision types as well as light reflection, absorption and transmission phenomenon this course goes on to define lighting terms: lighting methods, internal lighting systems and calculations, lighting apparatus and armatures and photometric measurements. Engineering problems such as pre-project preparation fundamentals, interior electrical installations, low current and high current systems and drawings. feeder, column and main-column line formation are discussed, followed by fundamentals of practical application project preparations, low power-factor correction methods in internal installations, voltage-drop calculation for lighting systems. In terms of practical work, hardware equipment for Computer Aided Design, representation of CAD Packet Program (AutoCAD). usage of primary drawing commands in 2-Dimentional drawing is included, together with text operations and project applications.

EEE361. Electrical machinery I
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
After brief reminder about electromagnetic circuits; properties of ferromagnetic materials. single-phase and three-phase transformers, per unit system is introduced. Principles of electromechanical energy conversion: Linear and nonlinear systems; singly and multiply excited, translational and rotational systems are the basic theoretical concepts leading to DC machines: Theory, generators, motors, speed control.

EEE362. Electrical machinery II
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course starts with electromagnetic fields created by AC electric machine windings: pulsating and rotating magnetic fields, emf induced in a winding. Based on these fundamentals, induction machines are introduced: equivalent circuit, steady-state analysis,

speed control, as well as synchronous machines: equivalent circuit, steady-state analysis, stability. Single-phase induction machines and special electrical machines are also covered.

EEE363. Renewable electric energy sources
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
Aim of this course is to make student understand and analyze energy conversion, utilization and storage for renewable technologies such as wind, solar, biomass, fuel cells and hybrid systems and for more conventional fossil fuel-based technologies. Use the First and Second Laws of Thermodynamics and introductory transport phenomena to form the basis of modeling renewable energy systems. Understand the environmental consequences of energy conversion and how renewable energy can reduce air pollution and global climate change.

EEE364. Power system analysis
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
Basic structure of electrical power systems are the starting point of the course, followed by electrical characteristics of transmission lines, transformers and generators. Representation of power systems and per unit system are introduced before faults, namely symmetrical three-phase faults, symmetrical components, unsymmetrical faults.

EEE365. Utilization of electrical energy
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
The course introduces basic operating characteristics and classification of electrical drives., solid state DC and AC motor control, dynamic behavior of electrical machines. Topics covered include electric braking. starting of electrical machines, intermittent loads, drive applications. From the practical viewpoint, modern methods of reactive power compensation and electrical energy saving are introduced.

EEE366. Electrical power transmission
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course explains the power system and discusses how to improve power transmission reliability in an effort to reduce the occurrence of power outages. The course reviews the power system fundamentals that apply to generation, transmission and distribution. It discusses the stability and reliability issues involved in an interconnected power system and the operation of the grid. The present regulatory environment is discussed and the measures to ensure stability are explained.

EEE367. Power system protection
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
Through investigation of current and voltage waveforms during faults and other conditions this course enables the study of distance and carrier-aided distance protection as well as new protection schemes applicable to high-speed protection. From the practical point of view, digital relaying and developments in integrated protection, control and measurement systems are explained.

EEE368. High voltage insulation technology
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course presents the mechanisms of electrical conductivity and polarization as well as the basic properties of insulating materials including their aging performance. The breakdown mechanisms and to compute the breakdown strength of insulation systems with simple geometries are introduced, as well as the breakdown mechanisms in order to approximately judge the breakdown strength of contaminated liquids and solids

EEE369. Distribution systems
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5

This course starts from basic considerations, namely load characteristics and forecasting methods, distribution substations, subtransmission, primary and secondary distribution. Choice of voltage levels. operational characteristics of cables, aerial lines and transformers are thoroughly explained, together with system voltage regulation, power factor correction, fusegear, switchgear, current and voltage transformers. Methods for overcurrent and thermal protection, earthling are introduced. Economics of distribution systems are analyzed.

EEE370. Industrial electronics
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
The course stars with a review of four layer devices and their applications. Gate control techniques in power switching elements and their protection, together with introduction to solid-state energy conversion. AC/DC, AC/AC, DC/AC and DC/DC converters provides the hardware foundation, and together with an introduction to control of electrical drives it enables students to learn about industrial control systems: Relay circuits; ladder diagrams. sequential control circuits. Case studies are included.

EEE371. Static power conversion
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
From power switches and their characteristics to power converter definitions and classification, this course gives a thorough introduction to questions of conversion. VTA method, midpoint and bridge rectifiers: non-ideal commutation, harmonics, input power factor, utility-factor, winding utilization and unbalances in rectifier transformers and their applications are some of the topics covered.

EEE372. Power electronics
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course introduces the semiconductor power devices and switching circuits first, followed by complementary components and systems. AC-to-DC converters. AC-to-AC converters. DC-to-DC converters. DC-to-AC converters are covered, as well as switching power supplies.

EEE373. Low voltage power systems
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
Starting with power calculations in distribution systems and power measurements, this course moves to secondary networks and load characteristics, voltage drop and power loss calculation in networks and voltage drop and power loss calculations for selection of conductor cross-sections. Other topics include low voltage power distribution in buildings, selection of fuses, contactors and power switches as well as grounding.

EEE374. Computer relaying in power systems
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course describes in detail the function block diagram of a computer relay and operating principles of different types of relays. Also it gives main classification of relay types and their behavior, mathematical background for understanding relaying algorithms and also examining line relaying algorithms and protection of transformers, machines and buses. It will be discussed about several hardware related question-such as the computer hierarchy in the substation, subsystems of a computer relay and analog to digital converters as and system relaying and control.

EEE375. Power system communication
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course gives description to parallel and distributed processing techniques that are applied to power system optimization and control. It will also give some briefing to load flow in power systems and basic theories about information system architecture in modern power system control centers. Another feature of the course is learning about transmission

congestion management, ancillary services management, state estimation and voltage/var optimization and control.

EEE376. Smart grid
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course will examine a set of emerging concepts, technologies, applications, and business models, and the complex trade off decisions related to transforming the nations century-old, centralized power grid into a more climate, sustainable-energy, and consumer-friendly "Smart Grid". Also the use of electric energy efficiency in power production & delivery, electric end-use energy efficiency, using Smart Grid to evolve the perfect power system and DC distribution using the Smart Grid will be examined.

EEE377. Sustainable distributed power generation
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
After an introduction to unconventional sources of electricity; energy conversion, generators selection, voltage levels selection, storage of energy, regulators selection, power converters;, this course also provides the economic implications of usage of non-conventional energy sources; connecting to the power system network; management and regulation.

EEE378. Power system quality
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course will provide students with overall understanding of the power quality problems and how do they interact with the system. In addition, possible measures to solve the power quality problems will also be discussed in this course.

EEE379. Industrial utilization of electrical energy
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
Extensive electricity utilization represents one of the hallmarks of a modern society. In this course, the basic concepts related to use of electric energy in various industrial applications and important issues related to such usage will be examined. The course also discusses issues related to economics of energy system usage and the concept of load management. Understanding the analytical methods and modern tools for solution of problems associated with utilization of electric energy in industrial sectors.

EEE380. Introduction to robot control
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
After brief introduction to robotics, this course deals with robot kinematics: position analysis, Denavit-Hartenberg representation, differential motions and velocities: the manipulator Jacobian, derivation of the Jakobian, inverse Jakobian. In addition, dynamic analysis and forces are covered: a short review of Lagrangian mechanics, dynamic equations for MDOF robots, static force analysis of robots. Trajectory planning. Actuators. Sensors. Image processing and analysis with vision systems, and finally the central point, robot control: independent joint control, multivariable control, force control, variable structure and adaptive control, fuzzy logic control.

EEE381. Process control
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course starts with a hardware introduction to process control: analog and digital signal conditioning, sensors: Thermal, mechanical, optical, final control: Industrial electronics, actuators, control elements. Discrete-state process control is introduced through: Relay controllers and ladder diagram, PLCs. Controller principles are explained thoroughly: Control system parameters, controller modes. Analog controllers. Digital control: Computers in digital control, process-control networks.

EEE384. Process instrumentation and control

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course focuses on the four major areas in automatic control systems: primary measurements, signal transmission, automatic controllers, and the final control elements. Describing typical installations as applied in various pulp and papermaking processes shows how these areas work together as systems. This course also provides a basic introduction to computers and their use in the paper industry.

EEE383. Discrete time control systems

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

Starting with a review of discrete-time systems and the z-transform. z-plane analysis of discrete-time control systems: Sampling and reconstruction, the pulse transfer function, realization of digital controllers and digital filters, this course proceeds with stability analysis of closed-loop systems in the z-plane, transient and steady-state response analysis. State-space analysis, pole placement and observer design, polynomial equations approach to control systems design are some methods studied within the course, summing up with quadratic optimal control systems.

EEE391. HDL based logic control

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

After an introduction to electronic design automation, this course starts with hardware modeling in HDL, event-driven simulation and testbenches. Defining logic system, data types, and operators for modeling in HDL, as well as user-defined primitives and propagation delay models, behavioral descriptions in HDL it leads to synthesis of combinational logic and sequential logic, language constructs, switch-level models and practical rapid prototyping with Altera FPGAs.

EEE394. Embedded systems

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This is practically-orientated and advanced course in the area of electronics design and applications. It is distinctive in that it provides a strong digital technology core backed up with applications-led modules. Examples of these applications include medical and electronics, e-health, intelligent building design, automotive electronics, retail and commerce. Another feature of the course is the substantial amounts of practical work, giving students the confidence with software and digital hardware implementations using microcontrollers or general system-on-chip the methodology.

CEN221. Object oriented programming

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

Object Oriented Programming is introduced through classes, objects, inheritance, polymorphism, graphical user interfaces, event handling, exception handling, files and streams, multithreading. Formalization is given through UML diagrams: Class, object, use-case, sequence and activity diagrams. Introduction to GoF design patterns and software design using UML and design patterns is a part of this course as well.

CEN254. Data structures

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course is a study of the basic data structures and their implementations using Arrays, matrices, stacks, queues, hash tables, trees, lists, and graphs. Programming techniques are practiced using recursion and various searching and sorting methods such as insertion sort, merge sort, and quick sort. Basic analysis of algorithms is conducted.

CEN361. Computer networks

Hours (Theoretical-Practical): 4 (2-2) **ECTS: 5**

This course introduces the reference model, Internet and TCP/IP. Application layer protocols: HTTP, FTP, SMTP, PO P3, and DNS are discussed. Socket programming, transport layer

services, flow and congestion control, network layer and IP protocol, addressing, routing, data link layer protocols, local area networks are main topics covered.

Elective courses (non-technical)

FES105. Fundamentals of management
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This is an introductory course about the management of organizations. It provides instruction in principles of management that have general applicability to all types of enterprises; basic management philosophy and decision making; principles involved in planning, organizing, leading, and controlling; and recent concepts in management.

FES365. Entrepreneurship
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course is designed for those who plan to start, or who have already started their own business. Individuals who hold leadership or management positions within a business, who are part of an existing family-business, or who want to know what it takes to be successful as an entrepreneur, will find real-world applications and solutions to the every-day challenges of owning and running a business here. In this course, students learn the essential attributes of an entrepreneur and the stages one goes through in taking the seed of an idea and growing it into a successful business.

MAN114. Introduction to business
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course presents a balanced view of business; the strengths, weaknesses, successes, failures, problems, and challenges. It provides students a base for more advanced courses.

IBS134. Leadership and corporate responsibility
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
The Leadership course offers students the opportunity to examine leadership theory, develop leadership skills and apply their knowledge and skills through a project.

ELT219. Oral expression and public speaking
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
In this course we will take “public speaking” to mean any speaking in front of others. In general the focus of the course will be on expanding the student’s speaking skills, going beyond simple “communication” to employ a more varied and effective vocabulary as well as non-verbal communicators (body-language, use of pauses, etc.). Specifically, the students will learn how to prepare and deliver different types of speeches including informative, explicative and persuasive.

ELT236. Educational psychology
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course introduces the relationship between education and psychology, description of educational psychology and its functions, the principles and practice of educational psychology, developmental stages (physical, cognitive, emotional, social and moral development), factors affecting learning, current theories of learning (motivation, individual factors, group dynamics, and factors affecting classroom learning).

ELT237. Teaching principles and methods
Hours (Theoretical-Practical): 4 (2-2) ECTS: 5
This course aims to develop the necessary skills and knowledge for ascertaining language learning requirements (e.g. situational, objective, subjective, and linguistic), needs analysis, and the preparation of objectives, drafting course schedules and preparing lesson plans. The course covers the following topics: different stages in lessons (presentation, practice, and

production), lesson planning and developing course requirements. The course aims to introduce teacher candidates to the following topics: types of course schedule and requirements, learning at different ages, attention to lesson objectives, choosing assessment criteria, descriptors of ability, criteria and application of English language criteria, the Common European Framework of Reference and the European Language Portfolio.