

Üsküdar University

**Department of Electrical-Electronics
Engineering**

Course Contents

Year One

1stTerm

MATH101 Calculus I

4 / ECTS: 6

Foundations, coordinates and vectors, functions, limits, continuity, derivative, tangent lines, the mean value theorem, graphing, extreme values, optimization problems, linearization and differentials, integration, Riemann sums and definite integrals, the fundamental theorem of calculus, natural logarithm, exponential functions, inverse trigonometric functions, L'Hospital's rule, methods of integration, applications of integrals.

PHYS101 Physics I

4 / ECTS: 6

Physics and measurements. Vectors; motion in one and two dimensions; the laws of motion; circular motion and other applications of Newton's Laws; work and energy; conservation of energy; linear momentum and collisions; rotational motion; angular momentum; equilibrium; gravitation, simple harmonic motion.

CHEM101 General Chemistry I

4 / ECTS: 6

Chemical foundations, atoms, molecules and ions, modern atomic theory, chemical compounds and their nomenclature, stoichiometry of chemical reactions, chemical calculations, reactions in solutions, precipitation, acid-base neutralization and oxidation-reduction (redox) reactions, gases, thermochemistry, periodic table and its properties, properties of solutions, chemical reaction kinetics and principles of chemical equilibrium. Laboratory experiments accompany the lectures.

EEE101 Orientation to Electrical Engineering

2 / ECTS: 3

The contents of the course cover electrical concepts, units, evaluation of basic electronics elements, explaining of basic theorems, resistance, inductance and capacitance, direct and alternating current circuits, electrical measurements. The social and ethical aspects of the engineering profession. Introduction to faculty members and research areas. General and departmental responsibilities of students.

ENG101 English I

3 / ECTS: 3

Reading texts and exercises. Listening exercises. Translation exercises. Writing essay. Speaking exercises, conversations.

RPSC109 Positive Psychology and Communication Skills

3 / ECTS: 5

The course includes subjects like the general framework of the basic concepts of communication sciences, solutions and recommendations to strengthen communication skills, interpersonal communication, group communication, organizational communication, mass communication, public communication, international communication and intercultural communication.

RCUL101 University Culture I

1 / ECTS: 1

The course consists of reports on seminars and conferences organized by the university.

Year One

2nd Term

COME102 Introduction to Algorithms and Programming

3 / ECTS: 4

Basic computer literacy: terminology, system components and operation. Fundamentals of computer programming: sequence, decision, repetition, syntax, compilation, debugging and maintenance, procedures, parameters, arrays, searching, sorting, top-down structured design, and style. Recursion, pointers and dynamic memory allocation; strings and string processing; advanced file processing; programmer-defined types; Introduction to Object Oriented Programming; classes and data abstraction: behaviour/state (data) model, member scope and access, constructors/destructors, object assignment.

EEE102 Introduction to Digital Systems

3 / ECTS: 5

Realization of Boolean functions, logic gates. Coding and debugging techniques. Logic minimization techniques. Flip-flops. Clock mode sequential circuits. Level mode sequential circuits. Counters. Race and hazard conditions in logic circuits. Introduction to hardware description languages.

MATH102 Calculus II

4 / ECTS: 6

Sequences and series, Taylor and Maclaurin series, lengths of plane curves, polar coordinates and complex numbers, lines, planes and quadratic surfaces in space, functions of several variables, limits and continuity, partial derivatives, differentiability, the chain rule, directional derivatives, extreme values, multiple integrals, integrals in polar, cylindrical and spherical coordinates, line integrals and surface integrals.

MATH104 Basic Linear Algebra

3 / ECTS: 5

Matrices, row equivalence, invertibility, systems of linear equations, determinants, Cramer's rule, vector spaces, linear dependence and independence, bases, inner product spaces, Gram-Schmidt orthogonalization process, orthogonal projections, Fourier series, eigenvalues, eigenvectors, exponential matrix, diagonalization and its applications, linear transformations and their matrices. Examples for each subject of this course are performed in Matlab.

PHYS102 Physics II

4 / ECTS: 6

Topics in Electricity and Magnetism: Electric charges and matter, Coulomb's law, electric fields, electric field calculations, motion of a charged particle in electric field. Gauss's law, electric flux and Gauss's law, applications of Gauss's law. Electric potential and electric potential difference, electric potential energy, electric potential due to point charges and charge distributions. Capacitance and dielectrics, definition and calculations of capacitances, energy stored in capacitors, capacitors with dielectrics. Current and resistance, electric current, resistance, electrical conduction. Direct-current circuits, electromotive force, Kirchhoff's rules, applications. Magnetic fields, definition and properties of Magnetic fields. Magnetic forces on charges and currents, applications of magnetic fields. Sources of magnetic fields, the Biot-Sawart Law, Ampere's law. Faraday's law, Lenz's law, induced electric fields, generators and motors. Inductance, mutual and self-inductance, RL circuits, energy in magnetic fields.

ENG102 English II

3 / ECTS: 3

Reading texts about profession, grammar exercises, word activities, translation activities, listening and speaking exercises.

RCUL102 University Culture II

1 / ECTS: 1

The course consists of reports on seminars and conferences organized by the university.

Year Two

3rd Term

EEE201 Circuit Theory I

4 / ECTS: 5

Basic concepts and definitions. Nodal and mesh equations. Analysis of resistive circuits. Network theorems. Sinusoidal steady state analysis. Power Calculations. Self and mutual inductances – transformers. Analysis of three-phase systems. Laboratory work.

EEE203 Computer Tools for Electrical Engineering

3 / ECTS: 4

Matlab expressions, constants, variables, arrays. Graph plots. Procedures and functions. Matlab syntax. Graphical User Interface (GUI). Linear algebra. Applications for electrical engineering.

EEE205 Digital Systems Design

4 / ECTS: 6

Logic synthesis and simulation using CAD tools, hardware description languages (verilog, system verilog), datapath and controller design, digital arithmetic, memory and control units. Field Programmable Gate Arrays (FPGA). Laboratory Work.

EEE207 Probability and Random Variables

3 / ECTS: 4

Fundamentals of probability. Random variables, distribution and density functions and some specific functions. Operations on one random variable: expectation, moments and transforms of random variables. Joint distribution and density functions. Statistical independence. Operations on multiple random variables. Random processes, stationarity, independence and ergodicity, correlation function. Spectral characteristics of random processes.

TURK101 Turkish Language I

2 / ECTS: 3

Definition of “language”, social role and importance, language-culture relationships, Turkish language and its place and relationships amongst the global languages, the history and development of Turkish language, current position and the hinterland of Turkish language. Phonetics and classification, characteristics of Turkish phonetics and the rules related to phonetics. Spelling rules and applications, punctuations marks and applications, general rules about essay writing, planning of essay writing, words and verbs, adverbs and prepositions with applications.

MATH203 Differential Equations

3 / ECTS: 5

Differential equations and basic concepts. Differential equations as mathematical models. Differential equations of general, special and unique solutions. Existence and uniqueness theorems. Separable, homogeneous, complete and fully convertible into ordinary differential equations. Of linear differential equations, Bernoulli's differential equation and its applications. Change of variables. General solution of n-th order linear differential equations. n-th order homogeneous differential equations with constant coefficients, the general solutions. Non-homogeneous equations with constant coefficients and solution methods. Initial and boundary value problems. Homogeneous and non-homogeneous differential equations with variable coefficients. Power series solutions of differential equations around ordinary points. Laplace and inverse Laplace transforms. Fixed and variable coefficient initial value problems. Systems of differential equations. Conversion of higher-order system of first order differential equations. Solutions of non-homogeneous diff. equations with constant coefficients. Application of Laplace transformation of differential equations systems. Methods for the numerical solution of differential equations.

ATA101 Principles of Atatürk and History of Turkish Revolution I

2 / ECTS: 3

In this course the meaning and the importance of the Turkish Revolution, the conditions which led to the Turkish Revolution, the environment and the developments, the National War of Independence under the leadership of Mustafa Kemal Pasha, the founding of the new Turkish State that is totally independent that rests upon national sovereignty, Ataturk as a genius soldier, as a great statesman, as a reformer and as a perfect organizer are presented.

RPRE104 Entrepreneurship and Project Culture

2 / ECTS: 3

The skills and knowledge which students will gain through this course are; 1. To learn scientific, academic and application oriented entrepreneurship, 2. To develop different perspective and manner of approaching corresponding with entrepreneurship, 3. To perceive and learn entrepreneurship with economical and social aspects, 4. To understand, entrepreneurship and especially economical entrepreneurship phenomenon as a system at a theoretical and practical level, 5. To be able to evaluate entrepreneurship processes and relations between them systematical and make it practicable, 6. To develop knowledge and skills at basic level about “marketing”, “financing”, “business establishment processes”, “applicable legal legislation” etc. which are closely associated with entrepreneurship and especially economical entrepreneurship. 7. To be able turn an opportunity into an idea and turn an idea into a business idea and evaluate this process, 8. To be able to create marketing, financial and business management plan and evaluate it, 9. To be able to make a feasibility study at a basic level.

Year Two

4th Term

EEE202 Circuit Theory II

4 / ECTS: 5

Natural response of electric circuits. Forced and total response in RL and RC circuits. Natural, forced and total responses of second order circuits. Resonance and filters. Frequency response and Bode plots. Laboratory work.

EEE204 Electromagnetic Field Theory

3 / ECTS: 5

This course provides coverage of all aspects electromagnetics. The course will focus on the more practical aspects of electromagnetic theory, the specific subjects covered will be vector analysis, electrostatics, electric current flow, magnetic fields, Maxwell’s equations.

EEE206 Numerical Methods for Electrical Engineering

3 / ECTS: 5

General Overview on numerical methods, which are most frequently applied in the electrical engineering with the solution of linear and nonlinear equations, interpolation, curve fitting, numerical differentiation, numerical integration, and numerical solution of partial differential equations. Applications of numerical methods for Electrical Engineering.

EEE208 Signals and Systems

3 / ECTS: 5

Signals and systems properties, Linear time-invariant systems, Fourier Series representations of periodic signals, Continuous-Time Fourier Transform, Discrete-Time Fourier Transform, Sampling, Laplace Transform, z-Transform.

TURK102 Turkish Language II**2 / ECTS: 3**

Components of a sentence, analysis and applications of the sentence, reading and investigating of the literature and philosophy examples from the world and rhetoric applications. Arts of written essay and applications, expression and grammar defaults and their corrections, the rules to prepare scientific articles.

ATA102 Principles of Atatürk and History of Turkish Revolution II**2 / ECTS: 3**

The struggle of the Turkish Nation to go above the level of the contemporary nations with all its institutions and values, Principles and Revolutions of Ataturk, Ataturk's School of thought, Turkey's national and international politics during Ataturk's leadership, Second World War and Turkey and the transition period to the multi political party era in Turkey.

EEE284 Summer Practice I**ECTS: 5**

The purpose of the internship, get to know the working environment of the electrical-electronics industry and universities to apply the information obtained in such a practical working environment.

Year Three**5th Term****EEE301 Electronics I****4 / ECTS: 6**

Semiconductors, PN junction, diodes, structure and operation principles of BJT. Biasing and small signal analysis of electronic circuits, structure and operation principles of FET and MOSFETs. Laboratory work.

EEE303 Communication Engineering**4 / ECTS: 6**

Building blocks of communication systems. Signal types, generalized functions. Hilbert transform and analytical signals. Linear and angular modulation methods, frequency division multiplexing. Sampling, quantization, Pulse-Code Modulation (PCM), Differential Pulse-Code Modulation (DPCM), Delta Modulation (DM), Time Division Multiplexing (TDM), pulse transmission. Baseband data transmission: Nyquist pulse shaping; Bandpass data transmission and digital modulation techniques. Noise analysis of modulation systems. Lab experiments of basic modulation schemes.

EEE307 Introduction to Microprocessors**3 / ECTS: 5**

Introduction to microprocessor architecture, software and interfacing concepts. Arithmetic operations and basic algorithms for microprocessors. Assembly and C language programming of microprocessors. Memory and I/O interfacing, microprocessor-based controller design. Introduction to operating systems for embedded computing. Laboratory work.

EEE305 Electromagnetic Waves**3 / ECTS: 5**

Solutions of Maxwell's equation in different media, transmission lines, waveguides, introduction to antennas

XXXXXX–Elective (2nd Foreign Language)**3 / ECTS: 5**

Year Three

6th Term

EEE302 Electronics II

4 / ECTS: 6

Analysis and design of BJT and MOSFET amplifiers, differential circuits, current sources, feedback, frequency response of amplifiers, power amplifiers, OPAMPs, oscillators. Laboratory work.

EEE304 Control Systems

3 / ECTS: 5

Introduction to control systems, mathematical modeling of control systems, transient and steady state response analysis, control systems analysis and design by root-locus method, control systems analysis and design by the frequency-response method and bode plots.

EEE3XX Departmental Elective I

3 / ECTS: 5

EEE3XX Departmental Elective II

3 / ECTS: 5

XXXXXX Social Elective I

3 / ECTS: 5

EEE384 Summer Practice II

ECTS: 5

The purpose of the internship, get to know the working environment of the electrical-electronics industry and universities to apply the information obtained in such a practical working environment.

Year Four

7th Term

EEE491 Graduation Project

2 / ECTS: 8

It covers developments in the field of engineering and the content may vary depending on the research interest of student and supervisor.

EEE4XX Departmental Elective III

3 / ECTS: 5

EEE4XX Departmental Elective IV

3 / ECTS: 5

XXX4XX Field Elective I

3 / ECTS: 5

XXX Social Elective II

3 / ECTS: 5

OHS401 Occupational Health and Safety I

2 / ECTS: 2

Year Four

8th Term

EEE492 Graduation Thesis	2 / ECTS: 8
Complete production and test procedure of the project that designed conceptually in EEE491.	
EEE4XX Departmental Elective V	3 / ECTS: 5
EEE4XX Departmental Elective VI	3 / ECTS: 5
XXX 4XX Field Elective II	3 / ECTS: 5
XXX 4XX Field Elective III	3 / ECTS: 5
OHS402 Occupational Health and Safety II	2 / ECTS: 2

ELECTIVE COURSES POOL

EEE306 Electrical Machinery	4 / ECTS: 5
The construction, classification and application areas of operational principles of rotating electrical machines, Steady-state equivalent-circuit models, torque-speed and current voltage characteristics and determination of model parameters of synchronous, induction and direct-current machines. Generator and motor operation of machines. General knowledge on special electrical machines such as single-phase alternating current machines and permanent magnet direct-current machines. Laboratory	
EEE308 Electromechanical Energy Conversion	3 / ECTS: 5
Energy technology and energy resources, Three phase systems and magnetic circuits. Transformers: Ideal and physical models and equivalent circuit, and transformer testing. Electromechanical energy conversion. Efficiency and process performance. Sensors and actuators: Relays, stepper and positioning systems, switched reluctance machines, synchronous reluctance machines, direct current (DC) machines. Symmetrical alternating current (AC) synchronous machines. Symmetrical AC induction machines.	
EEE310 Introduction to Data Structures and Algorithms	3 / ECTS: 5
Object oriented programming concepts (class structure, inheritance, polymorphism, information hiding etc.), Lists, queues, linked lists and binary search trees, searching and sorting algorithms, introduction to graphs.	
EEE312 Introduction to Computational Electromagnetics	3 / ECTS: 5
Analytical Methods, Finite Difference Methods, Finite Difference Time Domain for computational electromagnetics, Applications	
EEE401 Microcontrollers	3 / ECTS: 5
Typical architecture and internal units of microcontrollers. Flash memory technology and various memory access techniques. IIC, SPI and other serial communication units for microcontrollers, coding examples for microcontrollers and laboratory work.	
EEE402 Industrial Electronics and Automation	3 / ECTS: 5
Sensors and actuators for industrial electronics. Programmable logic controllers. Ladder diagrams. Open loop control techniques. PID control. AC and DC drives and applications to industrial systems. Mechanics for factory automation. Brushless motors and drives.	

EEE403 Health Effects of Electromagnetic Fields and Protection**3 / ECTS: 5**

Review of electromagnetic fields at different frequencies. Health effects of ELF and RF EM Fields. International regulatory activities and Safety standards. Human epidemiological studies. Site surveys, measurements and safety guidelines. Internal field Dosimetry. Health effects of Optical frequencies.

EEE404 Power Electronics**3 / ECTS: 5**

Semiconductor switching devices for power electronics (IGBTs, Thyristors, Diodes etc.); topologies and design of switching power converters (AC-DC, DC-DC and DC-AC); control of switching power converters; application examples.

EEE405 Introduction to Remote Sensing**3 / ECTS: 5**

Physical Bases of Remote Sensing. Radiation Characteristics of Natural Phenomena Sensors. Sensors Platform. Interpretation and Processing of Data. Introduction to Geographic Information Systems. Modeling Studies

EEE406 Introduction to Electromagnetic Compatibility**3 / ECTS: 5**

Introduction to Electromagnetic Compatibility. Non-ideal behavior of components. Crosstalk and cables. Digital circuit radiation. Shielding, Grounding. EMC standards. Open area test sites, Radiated interference measurements. Conducted interference measurements. Pulsed interference immunity.

EEE407 Microwave Electronics**3 / ECTS: 5**

High-frequency techniques, Maxwell equations and wave phenomenon; characterization of high-frequency circuits via S-parameters; Microwave devices, microwave passive and active components; microwave circuits and applications

EEE408 Introduction to Biomedical Signal Processing**3 / ECTS: 5**

Review of digital signal processing techniques, understanding basic properties of biomedical signals for their characterization, implement digital signal processing methods for noise removal and signal enhancement, implement frequency characterization of biomedical signals, implement digital signal processing techniques for practical problems of biomedical signal analysis.

EEE409 Wireless Wave Propagation**3 / ECTS: 5**

Introduction to the Wireless Communication Channel, Properties of Electromagnetic Waves, Propagation Mechanisms, Fundamentals of Antenna, Basic Propagation Models, and Terrestrial Fixed Links Satellite Fixed links, Macrocells. Microcells. Picocells, Antennas for Mobile Systems.

EEE410 Introduction to Robotics**3 / ECTS: 5**

Description and classification of robots, homogeneous transformations, forward and inverse kinematics, manipulator Jacobians, basic path planning, basic computer vision methods, and possibly some visual servo control.

EEE411 Modeling and Simulation**3 / ECTS: 5**

The basic concepts of computation through modeling and simulation being used by electrical-electronics engineers to shorten design cycles, innovate new products, and evaluate designs and simulate the impacts of alternative approaches.

EEE412 Embedded Systems Design**3 / ECTS: 5**

Fundamentals of embedded system hardware and firmware design, microcontroller architecture, glue logic, high level programming of embedded controllers, timer and interrupt structures, watchdog timer, hardware interfacing techniques, sensors and actuators. Operating system concepts for embedded systems, communication systems for embedded systems, laboratory experiments and term project.

EEE413 Introduction to Image Processing**3 / ECTS: 5**

Digital Image formation, human visual system, 2D signals and systems, image enhancement in time domain, image enhancement in frequency domain, image restoration, image segmentation, image compression, image analysis.

EEE414 Introduction to Digital Signal Processing**3 / ECTS: 5**

Sampling and quantization schemes. Linear shift invariant systems, stability and causality. Two-dimensional systems and sequences. Flow graphs, digital filter design techniques, FIR and IIR filters. Computation of Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT) techniques. Effects of finite register length. Estimation of power spectra. Discrete time random signals and systems.

EEE415 Mobile Communication**3 / ECTS: 5**

VHF and UHF communication in land-mobile communication. Channel characterization: fast and slow fading, frequency selectivity, delay and spread coherence bandwidth. Signal loss probability. Interference environments and its control. Frequency control. Diversity techniques for digital land mobile radio. Spatial distribution of offered traffic. Efficient spectral utilization. Capacity calculations and networking.

EEE416 Introduction to Digital Communication**3 / ECTS: 5**

Stochastic processes, noise analysis in analog communication, data transmission through AWGN channel, bandpass data transmission, equalization, optimum receiver design, carrier and pulse synchronization, error probabilities for binary/m-ary transmission, carrier modulation, Amplitude Modulation (AM), Phase Modulation (PM), Frequency Modulation (FM), Quadrature Amplitude Modulation (QAM) and their performances, entropy, quantization and rate distortion, information sources, channel capacity, coding.

EEE417 Introduction to Analog VLSI Circuits**3 / ECTS: 5**

Current sources, voltage reference design, Operational Transconductance Amplifier and OP-AMP structures, switched capacitor circuits, basics of analog filtering and gain circuits, process variation, layout design techniques, introduction to analog to digital and digital to analog conversion systems.

EEE418 Integrated Circuit Design**3 / ECTS: 5**

Electronics properties of logic Gates. NMOS and CMOS digital design principles. Layout design rules. Submicron design issues. Simulation of CMOS logic Gates. Logical effort, sequential circuit design. Basics of testing and verification of digital design.

EEE419 Control Technology and Design**3 / ECTS: 5**

An overview of design techniques with particular interest to industrial requirements. Feedback implementation: Transducers, sensors, and signal conditioning. Implementation of various types of control actions and servo control. Laboratory.

EEE420 Applications of Radio Wave Propagation**3 / ECTS: 5**

Electromagnetic problems and classification, Maxwell equations, Guided waves and transverse/longitudinal decomposition, Helmholtz equations, wave propagation over flat Earth, parabolic equation modeling, wave propagation over terrain, wave propagation inside rectangular waveguide.

EEE421 Energy Systems**3 / ECTS: 5**

Modelling and analysis of electric energy systems: single-phase and three-phase circuits (real and reactive power, per-unit systems); electromechanical energy conversion (construction, modelling and characteristics of transformers, DC, induction and synchronous machines); electric energy transmission and distribution (modelling of transmission lines, system analysis, control of voltage, power and frequency).

EEE422 Distribution Systems**3 / ECTS: 5**

Basic considerations. Load characteristics and forecasting methods. Distribution substations. Subtransmission, primary and secondary distribution. Choice of voltage levels. Operational characteristics of cables, aerial lines and transformers. System voltage regulation. Power factor correction. Fusegear, switchgear, current and voltage transformers. Overcurrent and thermal protection. Grounding methods. Economics of distribution systems.

EEE423 Power Systems**3 / ECTS: 5**

Introduction, Power Generation, Power Plants, Generators, Energy Transmission, Energy Distribution, Energy Usage 3-Phase Systems, Star-Connected Generators, Triangular Generators, 3-Conductor Systems, 4-Conductor Systems, Star-Connected Loads, Triangular Connected Loads, Balanced Loads, Unbalanced Loads, Power Measurement, Two Wattmeter Method Transmission Lines, Short Lines, Midlines, Long Lines, Power Calculation, Phasor Diagrams Applied Examples

EEE424 High Voltage Techniques**3 / ECTS: 5**

Electrostatic fields: basic electrode systems, approximate calculation of maximum electric field strength, electrode systems with multi-dielectrics, numerical methods for electrostatic field calculations. Introduction to discharge phenomena: discharge phenomena in gases (Townsend and streamer theories; corona, lightning, and surface discharges), discharge phenomena in solid and liquid dielectrics.

EEE450-459 Special Topics**3 / ECTS: 5**

Special topics in Electrical-Electronics Engineering selected to suit the individual interests of the students. The course is designed to give the student an opportunity to do independent work at an advanced level.