ISTANBUL TICARET UNIVERSITY

ELECTRICAL-ELECTRONICS ENGINEERING

UNDERGRADUATE PROGRAM COURSE CONTENTS

FIRST YEAR

1st Semester

FEF111 Physics 1 (3 0 3 4)

Physical quantities. Units and dimensions. Movement in one, two and three dimensions. Newton's motion laws. Work-energy, linear momentum and collisions, conservation of energy and momentum. Rotation, angular momentum, conservation of angular thrust. Static balance.

MAT121 Mathematical Analysis 1 (4 0 4 7)

Functions. Limit. Continuity. Vertical and horizontal asymptotes. Derivative. Applications of the derivative. Antiderivative. Fundamental theorem of differential and integral calculus. Integral.

FEF121 Physics Laboratory 1 (0 2 1 3)

Mechanics experiments: Systems of measurement and SI units. Simple pendulum, spring pendulum. Hook's Law. Movement in one and two dimensions. Conservation of angular momentum. Light interference experiment.

EEE101 Introduction to Electrical-Electronics Engineering (2 0 2 5)

Definition of electric charge, current, voltage, power and energy. Ohm's law. Kirchoff's current and Voltage law. Calculation of current and voltage measurements with D'Arsonval principle. Star-delta or Delta-star connected bridge circuits. Maximum power, superposition and resource conversion Theorems. Semiconductor technology and the use of diodes and transistors in circuits. Alternative Current signs.

BIL131 Programming 1 (2 2 3 7)

This course covers the fundamentals of programming (writing, compiling and executing programs), basic teaches and practice programming techniques, C programming language, development environments creates programs to solve problems.

LNG101 General English 1 (2 0 2 2)

Present tense. Now. Past tense. modals. Prepositions. They are actionable. Future tense. Dialogue. Role-play. Translation. Text reading.

GNL105 Turkish Language 1 (2 0 2 2)

History and basic rules of Turkish, reading exemplary literary and scientific texts.

ENG151 Software Tools for Engineering Design (2 0 2 3)

Basic programming knowledge (loops, conditions, functions), programming with MATLAB and numerical modeling, numerical modeling with SIMULINK, conversion of mathematical equations into codes and SIMULINK diagrams, graphing numerical results

2nd Semester

LNG102 General English 2 (2 0 2 2)

Positive sentences. Negative sentences and having questions. Will, Future tense with negative

sentences and questions. Gerunds and infinitive, Object pronouns with nonspecific amounts, Past progressive tense. positive sentences. Negative sentences and past progressive. Questions with sentences. Words related to adjectives. The order of conditional sentences: Type 1. Possessive pronouns. Manner envelopes.

GNL106 Turkish Language 2 (2 0 2 2)

Oral expression, definition and scope of speech, importance of speech, characteristics of oral and written expression. Principles of good, effective and correct speech, speech mistakes and pronunciation features of Turkish. Speech types. Oral expression types. Types of written expression. Official correspondence. Scientific research methods. Scientific report preparation. Citation, bibliography and footnote rules.

FEF112 Physics 2 (3 0 3 4)

Physics and measurements, electric charges; electric fields, electric potential; capacitance and dielectrics, current and resistance; direct current circuits; magnetic fields; magnetic field sources; faraday's law; inductance; alternating current circuits; RLC circuits; electromagnetic wave equations.

FEF122 Physics Laboratory 2 (0 2 1 3)

DC circuit analysis. Ohm's law, Kirchoff's law. AC circuit analysis. RLC circuits. Transformers and electromagnetic induction. Electrical measuring instruments, ammeter, voltmeter, ohmmeter, oscilloscope.

MAT122 Mathematical Analysis 2 (4 0 4 7)

3-dimensional coordinate system, vector valued functions and space curves. Multivariable functions. Limits and continuity, partial derivative, maximum and minimum problem, Lagrangian multiplier, double integrals, double integrals in polar coordinates, surface area, 3-fold integral, vector field, surface integrals. Green's theorem, Stokes' Theorem. Divergence Theorem.

BIL132 Programming 2 (2 2 3 4)

Fundamentals of programming, computer data processing logic, variables in programming, introduction to Simulink. If loop. While loop. For loop. Matrix operations with the for loop. Complex matrix operations with the for loop, image processing applications, examples of complex operations using arrays and matrices, examples of graphing functions using loops, examples of curve fitting operations to data, numerical derivative, integration, examples of operations to take a mathematical function to a limit, numerically a examples of solving functions approaching the value, examples of visual data processing.

ENG126 Engineering Mathematics 1 (3 0 3 5)

Linear Equation systems. Matrices. Linear Transformations. Determinants. Eigenvalues. Eigenvectors. Vector Spaces. Inner Product Spaces.

CHE101 General Chemistry (2 1 3 3)

Laboratory safety, periodic table, structure of the atom, structure of substances. Gases, Chemical bonds. Chemical reactions, Redox. Corrosion. Solids, Liquids, Gases Gases, Intermolecular forces, Solutions, normality, molarity. Normality, pH. Acids, Bases, salts. Experimental Chemistry.

SECOND YEAR

3rd Semester

GNL101 Ataturk's Principles and History of Revolution 1 (2 0 2 2)

This course is the first of a two-semester course on modern Turkish history. This course focuses on understanding the political, social, economic and cultural foundations of modern Turkey from the beginning of the nineteenth century to the end of the First World War. All aspects of Ottoman modernization will be examined and Tanzimat and Meşrutiyet will be evaluated to understand the transition process from empire to republic. Along with understanding the formation of modern Turkey, this course will also focus on the continuities and ruptures between Ottoman and republican Turkey.

EEE203 Logic Circuits (3 0 3 4)

Number systems. Operations with Boolean algebra, gate level minimization operations, combinational circuit design for logic gates, sequential circuit design.

ENG227 Engineering Mathematics 2 (3 0 3 5)

Linear equations, separable equations. Exact differential equations. Integral factor, variable substitution method. Fixed coefficient linear equations. Method of change of parameters.

ENG231 Probabilistic Methods in Engineering (3 0 3 5)

Counting Techniques: product rule, permutation, combination. Concept of Probability: Sigma algebra, axioms of probability, conditional probability, Bayes formula. Random Variable: Distribution function, probability function, Chebyshev inequality. Discrete and Continuous Distributions: Uniform distribution, Bernoulli distribution, Poisson distribution, geometric distribution, hypergeometric distribution, normal distribution, exponential distribution, gamma distribution, beta distribution. Subtracting Functions. Decision Theory. Prediction Concept. Hypothesis Testing. Non-Parametric Tests. Correlation and regression.

EEE205 Electrical Materials (3 0 3 5)

Atomic structure and atomic arrangement: structure of atoms. Interatomic bond strengths, distance between atoms. Effect of material properties on interatomic bond strengths, classification of materials. Crystal structures: Structural defects in the crystalline directions and planes of the crystal. Amorphous materials: gases, liquids, glasses and phases Solid solutions: Types of solid solutions, formation of solid solution composition and ionic compounds. Electrical properties: Electrical conductivity semiconductors. Dielectric properties, magnetic properties. Optical properties, thermal properties.

EEE213 Circuit Theory 1 (3 0 3 5)

Circuit variables. Circuit elements. Simple resistor circuits. Circuit analysis techniques. Operational Amplifiers. Responses of first-order RL-RC circuits. Natural and step response of RLC circuits. Laplace transform in circuit analysis.

EEE202 Circuits Laboratory (0 2 1 2)

Study of ammeter, voltmeter. Parallel series and mixed resistor circuits. Kirchoff's laws, Thevenin's and Norton's theorems. Experimental provision of Kirchoff's law for currents and voltages. Maximum power transfer. Analysis of RL/ RC and RLC circuits.

EEE225 Logic Laboratory (0 2 1 2)

Implementing Boolean functions with gate circuits, testing different combinational circuit designs, testing sequential circuit designs, doing counter and register experiments.

4th Semester

GNL102 Ataturk's Principles and History of Revolution 2 (2 0 2 2)

Political, economic, social and cultural history of Turkey between 1918 and 2014. Single-party period and transition to multi-party democratic political life. Turkish foreign policy during and after the Cold War, economic crises, neoliberal transformations, military-civilian relations and identity politics.

EEE210 Electronic Circuits 1 (3 0 3 6)

Analysis of diode circuits, DC and AC analysis of circuits with BJT transistors, DC and AC analysis of circuits with JFET transistors.

EEE301 Electronics Laboratory 1 (0 2 1 2)

Operational Amplifiers. Diode applications. BJT, JFET, MOSFET DC biasing and their applications as amplifiers.

EEE216 Circuit Theory 2 (3 0 3 4)

Phasor representations and solutions of circuits with phasor, circuit analysis in Laplace domain, extraction of circuit transfer functions and writing state equations.

ENG211 Numeric Analysis (3 0 3 5)

Mistake. Matrix Operations. Solution of linear systems AX=B. Solution of nonlinear equations. Solution of nonlinear systems of equations. Interpolation. Curve fitting (regression). Numerical derivative. Numerical Integral (Integral). Solution of differential equations. Reduction of higher order ordinary differential equations. Partial differential equations and their classification.

EEE206 Signals and Systems (3 0 3 5)

Signs and their features; Processing of signals, sampling; power and energy in signs, convolution; systems and their properties, time and frequency analysis of continuous-time periodic signals, Fourier series and Fourier transforms; time and frequency analysis of discrete-time signals, Fourier series and Fourier transforms; Laplace transform and inverse Laplace transform; system frequency response. Z transform.

EEE212 Electromagnetic Field Theory (3 0 3 5)

Vector Analysis; Static Electric Fields; Coulomb's law; Gauss's Law and Applications; Electric potential; Conductors in Static Electric Field; Dielectrics in Static Electric Field; Electric Flux Density and Dielectric Constant; Boundary Conditions for Electrostatic Fields; Capacitance and Capacitors; Electrostatic Energy and Forces; Constant Electric Currents; Current Density and Ohm's Law; Electromotive Force and Kirchhoff's Voltage Law; Continuity Equation and Kirchhoff's Current Law; Power Distribution and Joule's Law; Boundary Conditions for Current Density; Resistance

Calculations; Static Magnetic Fields; Vector Magnetic Potential; Biot Savart Law and Applications; Magnetic Dipole; Magnetization and Equivalent Current Densities; Magnetic Field Intensity and Relative Permeability; Magnetic Circuits; Behavior of Magnetic Materials; Boundary Conditions for Magnetostatic Fields; Inductors and Inductors; Magnetic Energy; Magnetic Forces and Torques.

EEE218 Circuits Laboratory 2 (0 2 1 2)

Measuring current and voltage in AC domain, empedance, examining inductor and capacitor, serial and parallel RL, RC , RLC circuits analysis, resonance and transformator.

THIRD YEAR

5th Semester

EEE311 Electronic Circuits 2 (3 0 3 5)

BJT and FET frequency response. Operational amplifiers and applications. Power amplifiers. Feedback and oscillator circuits. Power supplies (Voltage regulators). Other two-prong devices.

EEE317 Electronics Laboratory 2 (0 2 1 3)

Frequency response of amplifiers, linear and nonlinear applications of operational amplifiers and their non-ideal behavior, analysis of power amplifiers. Oscillators.

EEE313 Electromagnetic Wave Theory (3 0 3 5)

Review of electrostatics and magnetostatics, Faraday's law, Lenz's law, Eddy currents. displacement current. Maxwell's equations. Boundary conditions. Wave equations and solutions. Time-harmonic fields. Planar electromagnetic waves. Plane waves in different media. Electromagnetic power flow. Polarization, Perpendicular and oblique wave arrival to the planar conductive boundary. Perpendicular and oblique wave arrival to the planar dielectric boundary. transmission lines. Antennas.

EEE321 Communication Theory (3 0 3 5)

Building blocks of communication systems. Signal types, vector spaces. Generalized functions. Hilbert transformation and analytical signals. Linear and angular modulation methods, FDM. GM/SM applications. Stereo TV. Sampling, quantization. PCM, DPCM, DM, TDM. Pulse transmission; PAM, PDM, PWM. Baseband data transmission; Nyquist pulse sharpening. Bandpass data transmission and digital modulation techniques: ASK, PSK, FSK, QAM.

EEE300 Electromechanical Energy Conversion (3 0 3 5)

Basic concepts about magnetic circuits. single phase transformers. Three phase transformers. Electromechanical energy conversion. Working Principles of rotary electric machines. DA machines.

EEE327 Control System Theory (3 0 3 5)

Physical and abstract systems and mathematical models; classification of mathematical models: linear, time-invariant dynamical systems; finite state discrete event systems. Analysis techniques for linear systems; transform techniques, input-output analysis, block diagrams, frequency representation. Introduction to stability and closed-loop system design. Introduction to supervised control for discrete event systems. Simulation in Matlab environment.

University Elective Course (3 0 3 2)

6th Semester

EEE334 Electrical Machines and Power Electronics Laboratory (0 2 1 3)

Single and Three-Phase Transformer Experiments, Three Phase Induction Motor Experiments, Direct Current Machine Experiments, Single-Phase Uncontrolled Rectifier Experiments, Single-Phase Controlled Rectifier Experiments, AC-AC Voltage Controller Experiments, DC-DC Voltage Controller Experiments, DC-AC Converter Experiments, Three Phase Uncontrolled Rectifier Experiments.

EEE306 Microprocessors (3 0 3 6)

Getting to know the central processing unit of a microprocessor, learning the external memory design, writing programs with processor commands, recognizing peripherals such as I/O, ADC/DAC and using them in programs.

EEE336 Power Electronics (3 0 3 6)

General definitions, purposes of electronic power conversion, application areas, classification of power converters. Loss calculations of power semiconductors and cooling of semiconductors. Rectifier circuits. Transducer work in four quarters. AC voltage controllers. Chopper circuits. Inverters. Power converter protection systems.

ENG328 System Engineering and Project Management (2 2 3 3)

Project and project management definition, project life cycle, project charter, project management plan, project scope, work breakdown structure, project scheduling, cost, resources, risk, quality, communication, system engineering principles, requirements analysis, conceptual design, preliminary design, critical design, integration, test, acceptance.

EEE303 Electrical Machines (3 0 3 6)

Construction of synchronous machines, excitation fields and Fourier analysis, bipolar salient pole machines theory, reactions, armature reaction in synchronous generators and motors, equivalent circuits, no-load and full-load properties, phasor diagrams, short-circuit ratio, short-circuit current, synchronization, starting of synchronous motors, active and reactive power regulation, excitation methods, torque equations. Armature reaction, commutation, generator and motor characteristics, speed control and starting methods of DC machines.

University Elective Course (3 0 3 2)

Elective Course 1 (3 0 3 5)

Elective Course 2 (3 0 3 5)

FOURTH YEAR

7th Semester

ENG401 Design Project (0 4 2 10)

Problem recognition/definition, solution generation, solution selection methods, selection methodology, solution application, evaluation of application. Levels of learning and degrees of internalization. ethical decisions. Organization of business and design diary. Reverse engineering and design projects.

ENG402 Graduation Project (0 4 2 10)

Detailed literature search on a given design project topic. Defining the system, modeling it and applying the necessary method. Developing the prototype for the design. Giving the final shape to the design by making the necessary experiments and analyzes on the prototype. Detailed reporting of the design.

Elective Course 3 (3 0 3 5)

Elective Course 4 (3 0 3 5)

Elective Course 5 (3 0 3 5)

Elective Course 6 (3 0 3 5)

8th Semester

ENG402 Graduation Project (0 4 2 10)

Detailed literature search on a given design project topic. Defining the system, modeling it and applying the necessary method. Developing the prototype for the design. Giving the final shape to the design by making the necessary experiments and analyzes on the prototype. Detailed reporting of the design.

ENG401 Design Project (0 4 2 10)

Problem recognition/definition, solution generation, solution selection methods, selection methodology, solution application, evaluation of application. Levels of learning and degrees of internalization. ethical decisions. Organization of business and design diary. Reverse engineering and design projects.

GNL450 Vocational Educational Training (2 0 2 0)

To have successful professional people share their experiences about their career and life.

Elective Course 7 (3 0 3 5)

Elective Course 8 (3 0 3 5)

Elective Course 9 (3 0 3 5)

Elective Course 10 (3 0 3 5)

Elective Courses

EEE401 Hardware Description Languages (3 0 3 5)

Programmable hardware, PLD, FPGA; Basic verilog topics, Abstraction levels. Door-level modeling. Behavioral modeling. Modules and ports. Tasks and functions. Useful modeling techniques. Timing and delays. Key-level modeling.

EEE434 Antenna Design (3 0 3 5)

Antenna types and radiation mechanism. Basic antenna parameters: Radiation pattern. Beamwidth, Directionality. Earning. Beam efficiency. Band width. Polarization. Input impedance. Radiation efficiency. effective area. Friis transmission equation. Antenna temperature. Radiation integrals and auxiliary potential functions. Infinitely small (Hertzian) dipole. Small dipole. Finite length dipole, Ring antennas. Broadband dipoles and matching techniques. Frequency independent antennas: Log-periodic antennas. Microstrip antennas. Aperture antennas. Antenna measurement techniques. Antenna arrays.

EEE431 Embedded System Design and Architecture (3 0 3 5)

Embedded system definition. Central processing unit, memory, memory management system, peripherals, real-time operating system and software development, debug and simulation methods.

EEE405 Digital Communication Systems (3 0 3 5)

Building blocks of communication systems. Signal types, vector spaces, generalized functions, Hilbert transformation and analytical signals, linear and angular modulation methods, FDM. GM/SM applications, stereo TV. Sampling, quantization, PCM, DPCM, DM, TDM, pulse transmission; PAM, PDM, PWM. Baseband data transmission; Nyquist pulse sharpening, Bandpass data transmission and digital modulation techniques: ASK, PSK, FSK, QAM.

EEE460 Power System Grounding (3 0 3 5)

Grounding of power systems and equipment has an impact on system performance and safety, as well as on personnel and public health. Especially in distribution systems, it is of particular importance in terms of system reliability, service quality, sustainability and the safety of end-user equipment. The main objectives of this course are; To discuss the basic safety measures at Low, High and Medium voltage levels, to design a safe grounding facility, to discuss the issues of safety management in electrical installations.

MEE322 Control System Design (3 0 3 5)

Introduction to control systems. Investigation of Laplace transform. Transfer functions. Block diagrams. State space representation. Time response 1st order systems. Time response 2nd order systems. Stability. Basic Control; P, PD, PI, PID. Matlab review. Root locating techniques. Frequency domain: Bode plots. State space methods. Observability and controllability.

EEE411 Energy Distribution Systems (3 0 3 5)

Energy distribution. Energy distribution network types. Load characteristics. Voltage drop and power losses. Branched networks. Network networks. Underground cables and heat investigation criteria. short circuits. Busbars.

EEE328 Digital Signal Processing (3 0 3 5)

Introduction to Digital Signal processing and applications. Analog-digital I/O interface principles for real-time digital systems. Discrete transformations. Discrete Fourier transform. Fast Fourier transform, inverse fast Fourier transform and other discrete transforms. Z-transform and its applications in signal processing. Relationship inference and folding functions. Learning algorithms for numerical learning and voice recognition. Principles of digital filter design. Finite unit pulse response digital filter design. Windowing-based FIR filter design. Frequency sampling based FIR filter design. Recursive (IIR) digital filters and their design. Adaptive digital filters.

EEE418 Basic Engineering Tools and Applications (3 0 3 5)

Partial differential equations; Laplace, diffusion and wave equations; Bessel and Legendre functions, integral equations, functions of complex variables, proper mapping, complex integral calculus, series expansion and residue theorem.

EEE406 Mobile Communication (3 0 3 5)

Signals and channels, layered communication and OSI model, general concepts in data communication, SS7 networks, mobile network architecture, geographic architecture of mobile networks, mobile signaling.

EEE453 Microwave Techniques (3 0 3 5)

Definition of Microwaves. Basic features. Scope of application. Historical perspectives. Investigation of

TEM transmission lines in the sinusoidal steady-state regime from a circuit perspective. Smith Chart. Field analysis of transmission lines and waveguides. TEM, TM and TE Waves. Parallel plate and rectangular waveguides. Planar guide structures: Strip track and microstrip track. Microwave circuit analysis. Two-port circuits. Impedance and admittance matrices. Scattering parameters. ABCD matrix. Impedance matching. Single and double parallel line matching.

EEE447 Power Systems Analysis (3 0 3 5)

The course focuses on the basic concepts and methods of electrical power transmission and distribution. It introduces basic circuit elements and calculation techniques in transmission and distribution systems.

EEE448 Power Converter Design (3 0 3 5)

Basic definitions. Application areas and classification of power converters. power semiconductors. Loss calculations and cooling of power semiconductors. Transducer operation in four quadrants. Protection of power converters.

EEE451 Digital Image Processing (3 0 3 5)

(Brief) The main topics of this course include: 2D signal processing, 2D fundamental signals, 2D unit impulse and step signals; 2D linear time invariant systems and 2D convolution; 2D Discrete Fourier Transform and characteristics, Frequency response of 2D LTI systems; 2D digital FIR filters, general characteristics and design; Fundamentals of Image Processing, Gray level conversion, Gamma correction, Histogram Equalization; Image interpolation, linear interpolation, polynomial interpolation; Edge detection, edge identification, finite differences, Robert, Prewitt, Canny and Sobel edge detection; Midterm exam and course review; Image restoration, Image quality measurement, noise reduction; Color display, color reproduction; Color models, colored image filtering; Image compression and coding; 2D DCT, DST, Hadamard, KL transformations; JPEG standard, lossy and lossless JPEG compression standards.

EEE403 Active Filter Design (3 0 3 5)

Operational Amplifiers, First-order Filters: Bilinear Transfer Functions and Frequency Response; Second - Order Lowpass and Bandpass Filters ; Lowpass filters with maximally flat magnitude; Lowpass Filters with Equal - Ripple (Chebyshev) Magnitude Response; Inverse Chebyshev and Cauer Filters; Frequency Transformation; Sensitivity; Switched - Capacitor Filters

EEE429 Optoelectronics (3 0 3 5)

This course focuses on the physics of the interaction of photons with semiconductor materials. The band theory of solids is used to calculate the absorption and gain of semiconductor media. The rate equation formalism is used to develop the concepts of laser threshold, population inversion and modulation response. Matrix methods and coupled mode theory are applied to resonator structures such as distributed feedback lasers, tunable lasers and microring devices. The course is also intended to introduce students to noise models for semiconductor devices and to applications of optoelectronic devices to fiber optic communications.

EEE417 Biomedical Signals (3 0 3 5)

The aim of the course is to teach students that what is the biomedical engineering and computer applications in medicine, their research areas, biomedical data processing techniques.