NEAR EAST UNIVERSITY

ENGINEERING FACULTY

MECHANICAL ENGINEERING DEPARTMENT

BSc Handbook

February, 2018

CURRICULUM

FIRST YEAR – FALL SEMESTER

Code		CourseName	Credit/ECTS	Prerequisite
CHM	101	General Chemistry	4 / 5	
ENG	101	English I	3 / 3	
MTH	101	Mathematics I	4 / 6	
ECC	103	Engineering Drawing I	3 / 5	
PHY	101	General Physics I	4 / 6	
ME	100	ME Orientation	2 / 2	
YİT	101	Turkish for Foreign Students	2 / 3	

FIRST YEAR – SPRING SEMESTER

Code		Course Name	Credit/ECTS	Prerequisite
ECC	101	Introduction to Computers and Programming	3 / 6	
ENG	102	English II	3 / 3	ENG 101
MTH	102	Mathematics II	4 / 6	MTH 101
ECC	013	Engineering Drawing II	3 / 4	ECC 103
PHY	102	General Physics II	4 / 6	PHY 101
FNTE		Free Non-Technical Elective	3 / 5	

SECOND YEAR – FALL SEMESTER

Code		Course Name	Credit/ECTS	Prerequisite
MTH	201	Ordinary Differential Equations	4 / 6	MTH 102
ECC	211	Engineering Materials	4 / 7	
ECC	206	Statics	4 / 7	PHY 101
ECC	207	Thermodynamics I	4 / 7	
ENG	201	English III	3 / 3	ENG 102

SECOND YEAR – SPRING SEMESTER

Code		Course Name	Credit/ECTS	Prerequisite
EE	206	Electrical Machinery	3 / 4	PHY 102
ME	218	Applied Mathematics for Mech. Eng.	3 / 6	MTH 101
ECC	209	Manufacturing Technology I	3 / 4	
ECC	212	Dynamics	3 / 5	PHY 101
ECC	208	Thermodynamics II	3 / 5	ECC 207
ECC	213	Strength of Materials I	4 / 5	ECC 206
ME	200	Workshop Training	0 / 1	ECC 209

THIRD YEAR – FALL SEMESTER

Code		Course Name	Credit/ECTS	Prerequisite
ECC	304	Fluid Mechanics I	4 / 7	ECC 212
ECC	307	Machine Design I	4 / 6	ECC 213
ME	307	Strength of Materials II	4 / 6	ECC 213
ECC	305	Manufacturing Technology II	3 / 4	ECC 209
ECC	306	Heat Transfer I	4 / 7	ECC 207

THIRD YEAR – SPRING SEMESTER

Code		Course Name	Credit/ECTS	Prerequisite
MTH	323	Numerical Analysis	3 / 6	MTH 102
ECC	309	Theory of Machines I	4 / 5	ECC 212
ECC	308	Machine Design II	4 / 5	ECC 307
ECC	310	Control Systems	3 / 5	MTH 201
ME	314	Heat Transfer II	3 / 6	ECC 306
ME	300	Industrial Training	0 / 3	ME 200 / ECC 305

FOURTH YEAR – FALL SEMESTER

Code		Course Name	Credit/ECTS	Prerequisite
ME	403	Theory of Machines II	4 / 6	ECC 212 / MTH 201
ECC	424	Experimental Analysis of Mech. Eng. Systems	3 / 6	
TE		Technical Elective	3 / 6	
TE		Technical Elective	3 / 6	
TE		Technical Elective	3 / 6	

FOURTH YEAR – SPRING SEMESTER

Code		Course Name	Credit/ECTS	Prerequisite
ME	400	Graduation Project	4 / 7	
TE		Technical Elective	3 / 6	
TE		Technical Elective	3 / 6	
TE		Technical Elective	3 / 6	
RNTE		Restricted Non-Technical Elective	3 / 5	

Total 148 / 240

TECHNICAL ELECTIVE COURSES

ME 401	Hydraulic Machinery
ME 411	Heating, Ventilating, Air Conditioning and Cooling Systems
ME 415	Wind Engineering
ME 416	Solar Engineering
ME 418	Refrigeration Techniques
ECC 425	Internal Combustion Engines
ME 423	Heat Exchanger Design
ME 425	Machine Tools and Tool Design
ME 426	Introduction to Finite Elements Method
ME 429	Computer-Aided Design (CAD)
ME 431	Energy Conversion Systems
ME 433	Mass Transfer
ME 441	Fluid Mechanics II
ME 442	Gas Dynamics
ME 453	Materials Engineering
ECC 433	Heat Treatment
ME 461	Hoisting and Conveying Machines
ECC 434	Quality Control
ME 481	Biofuels

RESTRICTED NON-TECHNICAL COURSES

ECC 427	Management for Engineers
ECC 426	Economics for Engineers

COURSE DESCRIPTIONS

Compulsory Courses

ME 100 - Mechanical Engineering Orientation (2 credits): Introduction to mechanical engineering. Demonstrations of Mechanical Engineering Department Laboratories. Technical trips to various industrial sites. *Prerequisite: -*

CHM 101 - General Chemistry (3 credits): A basic course with emphasizing the metric system. Introduction to atomic theory, stoichiometry. The structural and physical properties of matter. Periodic relationship among elements and periodic table. Gaseous state. Thermochemistry. Energy and enthalpy. Electronic structure of atoms. Electrochemistry. Chemical bonding. *Prerequisite: -*

ENG 101 - English I (3 credits): Develops reading, writing, speaking, and listening skills by encouraging students to use language forms that they learn through reading and listening. The students are exposed to extensive reading both in and outside the classroom. They are encouraged to read a variety of texts such as short stories, academic articles, research reports, reviews and journalistic texts as well as chapters from textbooks. *Prerequisite: -*

MTH 101 - Mathematics I (4 credits): Functions, limits and continuity. Derivatives. Mean value theorem. Sketching graphs. Definite integrals, infinite integrals (antiderivatives). Logarithmic, exponential, trigonometric and inverse trigonometric functions and their derivatives. L'Hospital's rule. Techniques of integration. Applications of the definite integral, improper integrals. *Prerequisite: -*

ECC 103 - Engineering Drawing I (3 credits): Introduction to CAD. Principles of engineering drawing (1st and 3rd angle orthotropic projections), drawing methodology stages, linework and lettering, isometric and oblique projections, drawing layouts (working drawings and assembly drawings), machine drawing features, sections and sectional views, geometrical constructions and dimensioning principles. *Prerequisite: -*

PHY 101 - General Physics I (4 credits): Measurement, vectors, kinematics, force, mass. Newton's laws, applications of Newton's laws. Work and kinetic energy. Conservation of linear momentum. Impulse, collisions, rotation, moments of inertia. Torque, angular momentum, conservation of angular momentum, static equilibrium. *Prerequisite: -*

ENG 102 - English II (3 credits): Develops students autonomy, evaluation, analysis and research skills and synthesizing ability. Students will learn the discourse patterns and structures to be used in different essay types. An academic essay and a project report are assigned. *Prerequisite: ENG 101*

MTH 102 - Mathematics II (4 credits): Plane and polar co-ordinates, area in polar co-ordinates, arc length of curves. Limit, continuity and differentiability of function of several variables, extreme values, method of Lagrange multipliers. Double integral, triple integral with applications. Line integrals, Green's theorem. Sequences, infinite series, power series, Taylor's series. Complex numbers. *Prerequisite: MTH 101*

ECC 013 - Engineering Drawing II (3 credits): Working with CAD, screw threads and threaded fasteners, locking and retaining devices, keys and keyways, limits and fits, unilateral and bilateral limits, geometrical tolerancing and applications, gears, springs and spring calculations, weld types and symbols, dimensioning, bearings. *Prerequisite: ECC 103*

PHY 102 - General Physics II (4 credits): Electrical charges. Coulomb's law. Electrical fields. Gauss's law. Electrical potential. Capacitance and dielectrics. Current and resistance. Direct current circuits. Magnetic fields. Sources of the magnetic field. Faraday's law of induction. Inductance and inductors. *Prerequisite: -*

ECC 101 - Introduction to Computers and Programming (3 credits): An introduction to fundamental concepts. Algorithms and flowcharts as tools of program design process. Basic program structure. Input/output statetments. Control structures: Selection and repetition statements and arrays. Concept of modular programming: Procedures and Functions. *Prerequisite: -*

ME 200 - Workshop Training (Non-credit): This is to be completed in the Department's workshops by all ME students. Students will spend at least 80 hours in the workshops, and perform various hand and machine tool operations under staff supervision. At the end of the training students will be required to complete a report regarding their training. *Prerequisite: ECC 209*

MTH 201 - Differential Equations (4 credits): Ordinary and partial differential equations. Explicit solutions. First-order differential equations, separable, homogenous differential equations. Ordinary linear differential equations. Bernoulli differential equations. Cauchy-differential equations. High-order ordinary differential equations. Introduction to Laplace transforms. Introduction to series method for solving differential equations. Linear systems of differential equations. *Prerequisite: MTH 102*

ECC 206 - Statics (4 credits): Composition and resolution of forces, equilibrium of particles and rigid bodies, centroids and center of gravity. Analysis of trusses, frames and machines. Moments and products of inertia, method of virtual work. Friction. *Prerequisite: PHY 101*

ECC 212 - Dynamics (3 credits): A study of motion particles and rigid bodies. Application of Newton's second law to planar motions of rigid bodies, energy and momentum principles. Free, forced and damped vibrations of particle. Central force motions. Inertia tensor. Euler's equation of motion. *Prerequisite: PHY 101*

ECC 207 - Thermodynamics I (4 credits): Basic concepts and definitions of classical thermodynamics. Thermodynamic processes, work and heat interactions. First law for systems and for flow processes. Second law and entropy, irreversibility and availability. *Prerequisite: -*

EE 206 - Electrical Machinery (3 credits): Basic Electrical Elements and Circuit Fundamentals. Magnetic circuits. Ideal transformers. Three phase transformers. Application areas of transformers. DC motors and generators, AC machines and generators. Application areas of electrical machines. *Prerequisite: PHY 102*

ECC 208 - Thermodynamics II (3 credits): Thermodynamic cycles. Thermodynamics of mixtures and solutions, chemical reactions. Thermodynamic and mechanics of compressible fluid flow. Thermodynamic of energy conversion systems, refrigeration and air conditioning. *Prerequisite: ECC 207*

ECC 213 - Strength of Materials I (4 credits): Introduction. Internal force diagrams. Analysis of stress and strain. Hooke's law. Yield criteria and plasticity. Axial force. Pure shear. Torsion of circular bars and thin walled tubes. Moment of inertia of cross-sections. Simple bending. *Prerequisite: ECC 206*

ENG 201 - English III (3 credits): Being an inter-active course, students will be encouraged to listen actively, respond to presentations, and participate in discussions. The main goal is to enhance the students' competence and willingness to express themselves in an organized manner in academic and professional contexts, and to interact with others confidently. It is important that students learn to conduct independent research and think critically on issues raised in the course. *Prerequisite: ENG 102*

ECC 214 - Manufacturing Technology I (3 credits): Plastic forming of metals, hot and cold working, annealing and recrystallization. Technology of deformation processes. Forging and pressing, extrusion and rolling. Pipe manufacturing. Sheet working. Basic machine tool elements, metal cutting, turning, drilling and boring machines, milling machines, and cutters; sharpers and planars, grinding machines. *Prerequisite: -*

ECC 211 - Engineeing Materials (4 credits): Materials and properties. Atomic structure and interatomic bonding, crystal structure, crystal imperfections, solid solutions. Mechanical properties of materials, elastic and plastic deformation. Behaviour of materials under tension, compression and shear. Hardness and hardness measurement. Dislocation and strengthening mechanism. Phase equilibria, phase diagrams, the iron –carbon system, solid reactions, microstructures. Structure and properties of ceramics. Polymer structure. *Prerequisite: -*

ME 218 – Applied Mathematics For Mechanical Engineers (3 credits): Complex numbers, Matrix algebra, Methods of solution of linear equation systems. Vectors in 2D-Space and 3D-Space, Eigenvalues, Eigenvectors, Diagonalizations, Fourier Series. Applied Probability and Statistics. *Prerequisite: MTH101*

ME 300 - Industrial Training (Non-credit): This is a period comprising a minimum of 30 days training to be completed in an industrial organization by all students who are effectively in their junior or senior year. Students should obtain approval of the Department before commencing training. Following this training, students will be required to write a formal report and give a short presentation before a committee regarding their training. *Prerequisite: ME200 / ECC305*

MTH 323 - Numerical Analysis (3 credits): Approximations and errors. Accuracy and precision. Finite divided difference and numerical differentiation. Roots of equations, bracketing methods and open methods, systems of nonlinear equations. Systems of linear algebraic equations. Curve fitting, interpolation. Numerical integration. Ordinary differential equations. *Prerequisite: MTH 102*

ECC 304 - Fluid Mechanics (4 credits): Introduction, Fundamental concepts, Fluid statics, Basic equations in integral Form for a control volume, Introduction to differential analysis of fluid motion, Incompressible inviscid flow, Dimensional analysis and similitude, Internal incompressible viscous flow. *Prerequisite: ECC 212*

ECC 309 - Theory of Machines I (4 credits): Introduction to mechanisms: basic concepts, mobility, basic types of mechanisms. Position, velocity and acceleration analysis of linkages. Cam mechanisms. Gear trains. Static and dynamic force analysis of mechanisms. *Prerequisite: ECC 212*

ECC 307 - Machine Design I (4 credits): Introduction to mechanical engineering design. Load analysis, materials, deflection and stability. Stress analysis, stress concentrations. Strength of machine elements, theories of failure under static and dynamic loadings. Threaded fasteners, bearings riveted welded joints, springs. Lubrication and sliding bearings, rolling element bearings. Kinematics of spur gears. Design of spur gears. *Prerequisite: ECC 213*

ECC 308 - Machine Design II (4 credits): Analysis and design of machine elements. Helical, bevel and worm gears. Shafts and associated parts, keys, pins, splines, couplings, clutches, brakers and fly wheels, belts, chains, torque converters. Design project involving a mechanical component or device including all detail drawings, assembly drawings and cost analysis. *Prerequisite: ECC 307*

ME 307 - Strength of Materials II (4 credits): Stress and strain, Mohr's circle. Bending with shear. The shear center. The shear center of thin walled sections. Elastic curve for symmetrical cross-sections. Study of elastic curve by various methods. Effect of shear on the elastic curve. Axial force with bending. Materials not resistant to tension. Bending with torsion. Energy methods. Theorem of virtual work. Theorems of Betti and Castigliano. Minimum principles. Elastic stability. Euler cases. Buckling beyond the elastic limit, method of omega multiplier, approximate methods, Rayleigh ratio. *Prerequisite: ECC 213*

ECC 310 - Control Systems (3 credits): Introduction to automatic control. Mathematical modelling of dynamic systems. Response analysis using Laplace transform method. Transfer functions and block systems. Feedback control systems. Typical actuators and transducers. Control law. *Prerequisite: MTH 201*

ECC 305 - Manufacturing Technology II (3 credits): Basic manufacturing processes, nature and properties of materials, production of ferrous and nonferrous metals. Principles of metal casting, types of molding. Design of models and cores. Melting furnaces. Powder metallurgy. Welding, oxygen gas welding, torch cutting, electrical arc welding. *Prerequisite: ECC 209*

ECC 306 - Heat Transfer I (4 credits): Principles of heat transfer and their applications. Heat conduction in stationary systems. Transient Heat Conduction. Heat transfer associated with laminar flow and turbulence flow of fluids in forced and natural convection. *Prerequisite: ECC 207*

ME 314 - Heat Transfer II (3 credits): Numerical methods in heat conduction. Condensation and boiling. Heat transfer by radiation. Heat exchangers. Mass transfer. *Prerequisite: ECC 306*

ME 400 - Graduation Project (4 credits): The design process and morphology. Problem solving and decision making. Modelling and simulation. Use of computers in engineering design and CAD. Project engineering, planning and management. Design optimization. Economic decision making and cost evaluation. Aspects of quality. Failure analysis and reliability. Human and ecological factors in design. Case studies. A term project is assigned. *Prerequisite: (4th year student)*

ME 403 - Theory of Machines II (4 credits): Review and Concepts from Vibrations. Response of Single-Degree-of-Freedom Systems to Initial Excitations. Response of Single-Degree-of-Freedom Systems to Harmonic and Periodic Excitation. Response of Single-Degree-of-Freedom Systems to Nonperiodic Excitations, Two-degree-of-Freedom Systems. Multi-Degree-of-Freedom Systems. Vibration Control, Critical Speed of Shaft, Rotor Balancing. *Prerequisite: ECC 212 / MTH 201*

ECC 424 - Experimental Analysis of Mechanical Engineering Systems (4 credits): The need for experiments. Experimental procedure. Generalized measurement system. Report writing. Error treatment. Uncertainty. Frequency Distribution. Expected value, standard deviation. Presentation of experimental results. Plotting data. Curve fitting, linear regression. Non-linear relationships. Dimensional analysis. Laboratory experiments. *Prerequisite: (4th year student)*

Technical Elective Courses

ME 401 - Hydraulic Machinery: Introduction, Pipes. Turbopumps, Cavitation. Dimensional Analysis and Stimilitude for Turbomachinery, Use of Turbopumps in Piping Systems, Turbines, Pelton Wheels, Wind Turbines. *Prerequisite: ECC 304*

ME 411 - Heating, Ventilating, Air Conditioning and Cooling Systems: Fundamentals of local and central heating, heating elements, heat loss calculations, heating by hot water, pipe layout design. Local and central cooling, cooling elements, heat gain calculations, cooling by chilled water. Air conditioning, ventilation, heating and cooling by air, duct design. Design of central heating and cooling systems. *Prerequisite: - (ECC 306 recomended)*

ME 415 - Wind Engineering: Introduction and theory of wind energy and Betz limit, geographic and topographic distribution of wind velocity, area of application, types of wind turbines, research criteria of wind velocity distribution, wind data analysis, Helman coefficient, propellant profile data and usage, aerodynamics and characteristics of wind turbine propellers, design and control of wind turbines, efficiency of horizontal axis wind turbines, wind power, wind energy storage, general information on vertical axis turbines. Production of electricity. Economical considerations. *Prerequisite: ECC 304*

ME 416 - Solar Engineering: Sun, solar constant, radiation, spectral distribution and variation of extraterrestrial radiation, radiational properties of surfaces, solar angles, reckoning of time, radiation on horizontal and tiled surfaces, isolation on tiled surfaces, atmospheric attenuation of solar radiation, absorption of solar radiation, pyranometer, solar cells, solar plates, solar radiation data, estimation of solar radiation and clear sky radiation, beam and diffuse components pf radiation, energy storage. *Prerequisite: ECC 306*

ME 418 - Refrigeration Techniques: Application areas. Fundamentals of reversed heat engine cycles. Vapor-compression and absorption refrigeration cycles. Refrigerants. Absorption systems. Capacity control of refrigeration components. Cooling load calculations. System components: compressors, evaporators, condensers, expansion devices, piping, auxiliary and control devices. Cold storage rooms. Transportation of cooled materials. *Prerequisite: ECC 208*

ECC 425 - Internal Combustion Engines: Fundamentals of spark-ignition and compression ignition engines. Actual engine cycles. Combustion and detonation. Air capacity and super-charging. Carburetion and fuel injection. Engine friction. Heat rejection and cooling. Performance characteristics and testing. *Prerequisite: ECC 208*

ME 423 - Heat Exchanger Design: Parallel, cross and counter flow type heat exchanger design calculations. Evaporation. Evaporator and condenser types: tube and shell, mixing types, and compact heat exchanges. Thermal stress problems of heat exchanges. Optimization of heat exchanges. Construction problems. *Prerequisite: ECC 306*

ME 425 - Machine Tools and Tool Design: Mechanics of metal cutting. Metal cutting tools. Cutting fluids. Machine tool selection. Cutting speed, feed and depth of cutting. Turning, drilling, shaping, planning, milling and broaching. Abrasives, grinding wheels and grinding operations, Finishing operations. *Prerequisite: ECC 305*

ME 426 - Introduction to Finite Element Method: Analysis of stress and strain. Constitutive equations. Plane problems of elasticity. The finite element concept. One-and two-dimensional finite element formulation techniques. Transformations, assembly and solution techniques. Introduction to three dimensional finite elements. Project assignments of one and two dimensional problems. *Prerequisite: ME 307 / MTH 323*

ME 429 - Computer Aided Design (CAD): Introduction and principles of CAD, Stages in CAE, Hardware Components, Fundamentals of CAD, Design Process, Application of Computers for Design, Geometrical Transformations, (3D transformation, scaling, rotation), Representation of 3D objects, 3D Solid Modeling, (Boolean operations), Representation schemes. Parametric Design, brief description of FEA(finite element analysis), Merits and Limits of CAD. *Prerequisite: ECC 013*

ME 431 - Energy Conversion Systems: Energy demand and available resources in the world. Renewable sources: wind, wave, tide, geothermal, biogas and solar energy. Fossil fuels, combustion and combustion equipment. Steam generators. Atomic structure, nuclear reactions; decay, fusion and fission. Reactors. Environmental effects. *Prerequisite: ECC 207*

ME 433 - Mass Transfer: Fundamentals of mass transfer, principles of diffusion and diffusivity, molecular and convective mass transfer, phaseequlibria, equilibrium processes, absorbtion, membrane separation processes, leaching, distillation, drying andcrystallization, extraction, evaporation. *Prerequisite: ME 314*

ME 441 - Fluid Mechanics II: Flow Measurements. External incompressible viscous flow. Boundary layer theory. Potential flow theory. Turbomachinery, Introduction to compressible flow. *Prerequisite: ECC 304*

ME 442 - Gas Dynamics: Introduction to Compressible flow. Flow Regimes, Integral Forms of the Conservation quation for Inviscid Flows. One-Dimensional Compressible Flow. The Speed of Sound and Mach Number. Categories of Wave Propagation in a Compressible Flow. Normal Shock Waves. One-Dimensional Flow with Heat Addition. One-Dimensional Flow with Friction. Oblique shock and expansion waves. Quasi-One-Dimensional Flow. Area-Velocity Relation. Nozzles. Diffusors. *Prerequisite: ECC 304*

ME 453 - Materials Engineering: Engineering materials and properties. Materials selection and development. Thermal processing, specific examples. Some advanced materials. Design with brittle materials. Materials selection charts. *Prerequisite: ECC 211*

ECC 433 - Heat Treatment: Phase transformations in solids. Modification of material properties via the Processing – Structure – Property route. Types of heat treatment. Heat treatment of steels. Tool steels. Heat trearment of cast irons. Heat treatment of non-ferrous metals. Heat treatment of non-metalic materials. Materials damage at elevated temperatures. *Prerequisite: ECC 211*

ME 461 - Hoisting and Conveying Machines: Introduction to Material Handling, forms of transportable materials, basic elements of Hoisting, Block and Tackle Mechanisms, Lifting Mechanisms, Hoist types, Overhead travelling Cranes, Gantry Cranes, Column Jib Cranes, FEM standards, Conveyors (roller, gravity, screw and belt conveyors), conveyor components, Drive power calculations. *Prerequisite: ECC 212 / ECC 213*

ECC 434 - Quality Control: The purpose of the course is to make an introduction and lay the foundation of modern methods of statistical quality control and improvements that are used in the manufacturing and service industries along with basic concepts of reliability. The students will first be introduced to some of the philosophies of quality control experts and their impact on quality. This course familiarizes students with quality control techniques, quality assuarance issues and quality management methods. Finally basic concepts of reliability of systems will be introduced. *Prerequisite: -*

ME 481 - Biofuels: This is an elective course designed to acquaint the studentwith the current state of science and technology for the generation of energy from biologicallyderived sources. Topics covered include; sources of biomass feedstock, transesterification andbiodiesel fuel, fermentation and ethanol fuel, anaerobic digestion and biogas, thermal chemicalenergy transformation processes, and advanced biofuels, legislation on biofuels. *Prerequisite: -*

Restricted Non-Technical Courses

ECC 426 - Economics for Engineers: Principles and economic analysis of engineering decision making. Cost concept. Economic environment. Price and demand relations. Competition. Make-versus-purchase studies. Principles and applications of money-time relations. Depreciation. Many and banking. Price changes and inflation. Business and company finance. *Prerequisite: -*

ECC 427 - Management for Engineers: Principles of management. Functions of managers. Organisation and environment. Marketing management. Production management. Personnel management. Managerial control. ACCOUNTING and financial reports. Budgeting and overall control. *Prerequisite: -*