Mechanical Engineering Program

FIRST YEAR

I. SEMESTER

MATH113 Mathematics-I, 4 credits, 6 ECTS

Real numbers. Functions, graph of functions. Limits and continuity. Differentiation, chain rule, implicit differentiation. Applications of derivatives, mean value theorem, indeterminant forms, curve sketching.

ATA111 History of Turkish Revolution-I, 2 credits, 2 ECTS

At the end of World War I, to rescue Anatolia from the invasion including congress, “National Liberation Struggle” that was won in a very difficult conditions, and by opening TBMM via executing the management on one hand “the armed actions of the National Liberation War period, “ winning the War of Independence despite all impossibilities and preparing the required ground for the Turkish Revolution”.

CHM101 Chemistry, 3 credits, 5 ECTS

The importance of chemistry in Electrical and Electronics Engineering, Material and Chemistry, Fundamental Laws of Chemistry, Atom and molecular weight, mole, Avogadro Number, Chemical Calculations, Symbols, Formulas and Equations, Solids, Chemical Thermodynamics, Reaction Velocity and Balance, Balance in Aqueous Solutions, Electrochemistry and Corrosion, Periodic Table and the structure of the atom, Chemical Bonds, Redox Reactions

PHYS113 Physics-I , 3 credits, 5 ECTS

Vectors, kinematics, Newton's laws of motion, work and energy, conservation of energy, linear momentum and its conservation, rotation of rigid bodies about a fixed axis, angular momentum and its conservation.

ME101 Introduction to Mechanical/Automotive Engineering, 3 credits, 6 ECTS

History and emergence of mechanical and automotive engineering. Basic concepts and subjects, fields of work, qualifications and skills of mechanical and automotive engineers, an overview of the mechanical and automotive engineering curriculums at Okan University.

TRD111 Turkish-I, 2 credits, 2 ECTS

Definition of language, the relationship with culture, the phonetic structure of Turkish, The structure of words (stem, base and suffixes, etc,), sentence structure, analysis of selected books such as narratives, poetry books and essays.

Foreign Language Elective

II. SEMESTER

MATH114 Mathematics-II, 4 credits, 6 ECTS

Integration, fundamental theorem integral calculus. Application of definite integrals; area between curves, volumes calculation, lengths of plane curves, area of surfaces of revolution. Trancendental functions; exponential functions, logarithms, hyperbolic functions. Techniques of integration.

ATA112 History of Turkish Revolution-II, 2 credits, 2 ECTS

The Eastern Front, The struggle with Armanians and Gümrü Agreement, The Western Front, The Wars of İnönü, Sakarya and Dumlupınar, Mudanya Agreement and the end of sultanate, Lozan Peace Conference and the establishment of Republic, The New Republic, The opposition and Progressive Republican Party, The renovations in education and culture, The Mousul question, The experiment of Multiparty system- Liberal Republican Party.

PHYS114 Physics-II, 3 credits, 5 ECTS

Charge and matter, the electric field, Gauss law, electrostatic potential, capacitance, current and resistance electromotive force and circuits, The magnetic field, Ampére's law, Faraday's law, Inductance, Magnetic properties of matter.

TRD112 Turkish-II, 2 credits, 2 ECTS

Historical development of Turkish, Today's Turkish, Turkish Grammar, Text Analysis.

ME102 Statics for Mechanical Engineers, 3 credits, 8 ECTS

Vectors, forces, rectangular components, moment, couple, resultant. Two and three dimensional force systems. Equilibrium in two and three dimensions. Free body diagram. Plane trusses, method of joints, method of sections, space trusses, frames and mchines. Centers of mass and centroids. Cables. Friction. Virtual work.

Foreign Language Elective

SECOND YEAR

III. SEMESTER

MATH215 Mathematics III, 3 credits, 6 ECTS

Matrix algebra, determinants, Gaussian elimination, Cramer's rule, inverses, Systems of linear equations, Rank, Eigenvalues and eigenvectors, introduction to linear programming. Determinants. Vector spaces.

ME201 Computer Aided Technical Drawing, 3 credits, 5 ECTS

The first half of this course is devoted to drafting by hand and the second half is devoted to using CAD(Computer Aided Design). Instrumental drawing, multiview projections, sectional views, auxiliary and oblique views, dimensioning and tolerancing, 3D sketching (include extruding, protrusions, revolving etc.).

ME207 Engineering Materials, 3 credits, 8 ECTS

Classification of materials. Atomic structure and interatomic bonding. The structure of crystalline solids. Crystalline and noncrystalline materials. Imperfections in solids. Mechanical properties of materials. Phase diagrams and phase transformations. Metal alloys. Structure and properties of ceramics, polymers and composites. Electrical, magnetic, thermal and optical properties of materials. Performance of materials in service.

ME209 Thermodynamics I, 3 credits, 7 ECTS

Introduction to thermodynamics, ideal gasses, internal energy, enthalpy, energy transfer by work, heat and mass, the first and second laws of thermodynamics, refrigerators and heat pumps, Carnot cycle, entropy, reversibility.

University Elective

IV. SEMESTER

MATH216 Mathematics IV, 3 credits, 6 ECTS

Definition of a differential equation, families of curves. First order differential equations. Linear differential equations. Nonhomogeneous equations, undetermined coefficients, variaton of parameters. Systems of linear equations. Laplace transform.

ME210 Mechanics of Materials I, 3 credits, 5 ECTS

Axially loaded bars, Analysis of stress and strain. Mohr's circle. Torsion. Transverse loading of beams. Stresses in beams. Deflection of beams. Design of shafts and beams under combined loading. Statically indeterminate problems. Energy methods.

ME212 Computer Aided Mechanical Design, 3 credits, 6 ECTS

Students in this course will be introduced to basic 3D solid modeling, sketching, and assemblies of mechanical parts by using SolidWorks. The course material will consist of the combination of two parts. Part I covers the principles of SolidWorks, simple and advanced part modeling approaches, assembly modeling, drawing, and integrating SolidWorks with AutoCAD drawings. Part II covers the applications of SolidWorks in manufacturing processes and mechanical systems. The manufacturing processes applications include mold design, sheet metal parts design, die design, and welding drawings. The mechanical systems applications will include parts like: pipes, gears, pulleys, belts, chains, vents, cams, linkages and springs, hinges, threads and fasteners.

CMPE152 Computer Programming, 3 credits, 5 ECTS

Structural programming concept. C Programming Language (Fundamentals, Data types, Statements, String functions. Array manipulations. Procedures and Functions, Units). Recursion. Sort and Search algorithms. Basic file applications. Dynamic variables and elementary data structures (Pointer, Stack, Queue, Linked list).

University Elective

THIRD YEAR

V. SEMESTER

ME315 Mechanical Experimental Lab I, 3 credits, 5 ECTS

Statistical basics of engineering experiments are presented. The components of a measurement systems are defined.

ME305 Machine Design I, 3 credits, 5 ECTS

Review of load analysis, materials, stress and strain. Types of failures, fracture mechanics, static failure theories, stress theories, modified Mohr theory, safety factors, reliability. Linear, bending and torsional impact. Fatigue for elements under torsional, bending and axial stress. Influence of surface and size on fatigue strength. Fatigue life with random varying loads. Surface damage with corrosion, adhesive and abrasive wear. Surface fatigue failures.

ME307 Fluid Mechanics I, 3 credits, 5 ECTS

Hydrostatics, kinematics of flow, continuity equation, Euler's and Bernoulli's equations, viscous flow equations, head loss in ducts and piping systems, momentum theorems, dimensional analysis and similitude, potential flow, circulation and vorticity.

ME309 Dynamics, 3 credits, 5 ECTS

Dynamics of particles: Rectilinear and curvilinear motion. Newton's laws, momentum and angular momentum methods. Work and energy. System of particles. Dynamics of rigid bodies in plane motion; kinematics. Work and energy methods for rigid bodies.

ME313 Systems and Control, 3 credits, 5 ECTS

Modeling in time domain and frequency domain, time response, stability, steady state errors, block diagrams, root locus and frequency techniques, design by root locus and frequency techniques.

EEE207 Circuit Analysis, 3 credits, 5 ECTS

Physical electrical circuits. Modeling and measurements of currents and voltages in physical circuits. Definitions of charge, flux, power and energy and modeling their waveforms. Kirchoff's Laws: current and voltage equations. Independent sets of current and voltage equations. Ideal 2-terminal and multi-terminal circuit elements: linear and nonlinear resistors, inductors and capacitors. Modeling of physical elements. Small signal analysis. Solution of resistive circuits: node voltage and mesh current methods. Network theorems. Solution of dynamic circuits: responses of first and second order dynamic circuits.

VI. SEMESTER

ME302 Heat Transfer I, 3 credits, 4 ECTS

Transient and steady state one dimensional heat transfer, two dimensional steady state heat transfer, surface heat transfer, numerical methods, radiation heat transfer, heat exchangers, introduction to convection heat transfer.

ME306 Machine Design II, 3 credits, 4 ECTS

Threaded fasteners and power screws. Rivets, welding and bonding. Springs. Lubrication and sliding bearings. Rolling element bearings. Spur gears: gear force analysis, gear tooth strength, gear tooth durability, gear tooth fatigue analysis and gear materials. Helical, bevel and worm gears. Shafts and associated parts. Clutches and brakes. Machines components such as flat belts, V-belts, toothed belts, roller chains, inverted tooth chains, fluid couplings and hydrodynamic torque converters.

ME310 Theory of Machines, 3 credits, 6 ECTS

Planar mechanisms, kinematic analysis of mechanisms, cams, gears, gear trains, inertia force analysis, balancing of rotating components, balancing of linkages, gear forces, vibration.

ME312 Manufacturing Techniques, 3 credits, 3 ECTS

Manufacturing technology concept, manufacturing processes, casting, welding, plastic forming methods of metals and machining methods, sintering. Forming of ceramics, plastics and composites.

ME314 Principles of Mechatronics, 3 credits, 5 ECTS

General introduction to all the topics of mechatronics. Basic applied concepts in mechatronic components and instruments. Sensors and transducers, machine vision, actuating devices. Information and cognitive systems, hardware components for mechatronics. Laboratory experiments on identification and classification of mechatronic components.

MATH220 Numerical Methods, 3 credits, 4 ECTS

This course is designated to provide the necessary knowledge and skills in analysis of numerical methods to investigate numerical errors, Taylor's theorem, numerical solutions of linear and nonlinear equations, interpolation and curve fitting methods, numerical differentiation and integration, numerical solutions of differential equations.

FOURTH YEAR

VII. SEMESTER

ME407 Mechanical Experimental Lab II, 3 credits, 8 ECTS

Weekly experiments from different areas of mechanical engineering. A weekly report is written for every experiment.

ME497 Mechanical Engineering Design, 1 credits, 4 ECTS

In this course which consists of the design of a complex system, process, device or product, within the framework of preferrably a multi-disciplinary engineering problem, under realistic constraints, and taking into consideration social, economic and environmental conditions as well as relevant national and international standards and characteristics of sustainability and manufacturability, without compromising ethical principles, the student is required to document the requirements specification and the design in conformance with international standards.

BBA222 Entrepreneurship Applications, 2credits, 3 ECTS

VIII. SEMESTER

ME462 Heat Transfer II, 3 credits , 11 ECTS

Transient Conduction, external forced convection, internal forced convection, natural convection, boiling and condensation, heat exchangers, mass transfer, radiation, numerical solutions to heat transfer problems.

ME498 Mechanical Engineering Graduation Project, 2 credits, 4 ECTS

This course consists of the implementation based on accessible resources, then testing and validation of the level of satisfaction of the requirements followed by the documentation of all this process in conformance with international standards, and its defense in front of a jury, of a complex system, process, device or product, designed within the framework of preferrably a multi-disciplinary engineering problem, under realistic constraints, and taking social, economic and environmental conditions as well as relevant national and international standards and characteristics of sustainability and manufacturability into consideration, without compromising ethical principles.

ELECTIVES

ME451 Engineering Applications of Dynamics, 3 credits , 5 ECTS

Newton's Laws. Energy and Lagrange equation methods. Computer solution of equations of motion. Newton's laws in a body fixed plane. Mechanical systems under active control. Rigid body motion in three dimensions.

ME453 Thermodynamics II, 3 credits , 5 ECTS

Vapor power and gas cycles. Refrigeration cycles. Thermodynamic relations. Mixtures of gases, application to Hygrometry and air conditioning. Chemical reactions. Combustion. Chemical equilibrium.

ME455 Fluid Mechanics II, 3 credits , 5 ECTS

Introduction to turbomachinery. Head loss. Kinematics of flow in a turbomachine. Velocity triangles. Impulse turbine. Axial and radial flow machines. The affinity laws. Some design aspects of turbomachines, linear and radial cascades. Cavitation.

ME457 Mechanics of Materials II, 3 credits, 5 ECTS

Inelastic material behavior, applications of energy methods, curved beams, beams on elastic foundations, the thick-wall cylinder, elastic and inelastic stability of columns, flat plates, stress concentrations, fracture mechanics, fatigue – progressive fracture, contact stresses, creep - time dependent deformation.

ME461 Systems and Control II, 3 credits, 5 ECTS

State space control, controllability, observability, minimal realizations, stability, linear state feedback control rules and design, observers and observer based compensators.

ME452 Vibration, 3 credits, 5 ECTS

Elements of vibrating systems. Free vibration of one degree of freedom systems. Harmonic excitation of one degree of freedom systems. Transient vibrations of one degree of freedom systems. Multi degree of freedom systems. Derivation of governing equations. Free vibration of multi degree of freedom systems. Forced vibration of multi degree of freedom systems. Vibration control.

ME454 Mechanical Behavior of Materials, 3 credits, 5 ECTS

The goals of this course are to provide an introduction to the mechanical behavior of engineering materials including metals, ceramics, polymers and their composites. The student will have familiarity with the basic mechanics of elastic and plastic deformations, strengthening and fracture.

ME458 Introduction to Finite Element Analysis, 3 credits, 5 ECTS

Application of finite element methods to different mechanical engineering areas. These areas include stress analysis, heat transfer and fluid flow.

ME460 HVAC, Heating, Ventilation and Air Conditioning, 3 credits, 5 ECTS

Air-conditioning systems, moist air properties and conditioning processes, comfort and health-indoor environmental quality, heat transmission in building structures, space heating load, solar radiation, the cooling load, energy calculations and building simulation, flow, pumps and piping design, space air diffusion, fans and building air distribution, direct contact heat and mass transfer, extended surface heat exchangers, refrigeration.

ME491 Special Topics in Mechanical Engineering, 3 Credits, 5 ECTS

AUTO407 Vehicle Dynamics, 3 credits, 5 ECTS

Tire modeling, longitudinal vehicle dynamics, driveline dynamics , lateral vehicle dynamics (kinematic model, bicycle model, stability), suspension modeling (suspension kinematics, camber, quarter car model, half car model, vibration, frequency response), roll dynamics (roll angle, anti-roll bars, roll-over), steering mechanism (ackermann steering) hydraulic boost, electric boost, caster angle, toe angle), trailer dynamics, trailers with steering.

AUTO460 Internal Combustion Engines, 3 credits, 5 ECTS

Spark ignition and compression ignition engines, thermochemistry of fuel air mixtures, combustion, cooling of engines, fluid motion inside combustion chamber, engine friction losses and lubrication, design and control principles, testing and control principles.

AUTO471 Automotive Body and Interior Design, 3 credits, 5 ECTS

Principles of vehicle body design, CAD methods, Center of gravity, longitudional stability, lateral stability, aerodynamics and its effect on vehicle body.

AUTO472 Alternative Drive Systems, 3 credits, 5 ECTS

Alternative fuel vehicles, hydrogen and fuel-cell vehicles, hybrid and electric vehicle design and architecture principles, basic components, critical energy management problems, effect on carbon emission and social end infrastructure issues

AUTO473 Automotive Aerodynamics and Thermal Systems, 3 credits, 5 ECTS

Basic principles of aerodynamics and heat transfer, effect of aerodynamics in car design, basic thermal systems in vehicles, design principles of thermal systems, ergonomics and comfort principles related to thermal systems design.

AUTO462 Vehicle Controls, 3 credits, 5 ECTS

Longitudinal control of vehicles (cruise control, adaptive cruise control, automated highway systems, ABS), lateral control of vehicles (automated lane following, vehicle stability control, automated parking, ESP), active suspensions, active anti-roll bars, semi-active suspensions, road friction estimation, roll over prevention, control of four independent electric motor drive vehicles, electric steering control, electro-hydraulic steering control.

AUTO303 Vehicle Development Fundamentals, 3 credits, 5 ECTS

Products portfoglio plan, vehicle specs preparation, Project management principles, Vehicle architecture, vehicle drive train selection, vehicle performance calculations, fuel consumption calculations, vehicle homologotion principles, safety issues, design FMEA.

AUTO308 Automotive Electronics and Mechatronics, 3 credits, 5 ECTS

Automative electric system architecture and network, CAN systems, Flexray, energy requirements, basic components, basic electronic control units, and their relation, embedded software preparation basics, testing methods and homologation effects, sensors and characteristics, future of automotive electronics.