NEAR EAST UNIVERSITY

DEPARTMENT OF Automotive Engineering

Course Structure Diagram with Course Credits

2021-2022

Courses List with Near East University credits and ECTS

Please see the attached example of the diploma supplement which is given to all graduates of our university free of charge. It is arranged in English.

The diploma supplement is a document the purpose of which is to provide sufficient independent data to improve the international “transparency” and fair academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.). It is designed to provide a description of the nature, level, context, content and the status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free from any value judgments, equivalence statements or suggestions about recognition.

COURSE OBJECTIVES AND CONTENTS:

YEAR 1

Orientation (course type: required; course code: AUE100)

Course objective: The aim of this course is to introduce students to automotive engineering as a program and the working life of automotive engineers.

Course content: Introduction to automotive engineering working areas. Information on department and laboratories. Industrial trips.

Turkish for Foreigners (course type: required; course code: YİT100)

Course objective: The aim of this course is to help students interact with non-English speaking people within their community.

Course content: Listening, written expression, oral expression, reading, conversation, grammar and translation.

English I (course type: required; course code: ENG 101)

Course objective: This course aims at enabling students to understand their lessons and to express themselves in English Language.

Course content: Within a thematic approach, reading, writing, speaking, and listening skills will be developed, with a language component in order to build onto the foundation established at the Department of English. In speaking and writing, students will be encouraged to use language forms that they learn through reading and listening. Under broad themes (or threads), the students will be exposed to extensive reading both in and outside the classroom. They'll be 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

General Chemistry (course type: required; course code: CHM 101)

Course objective: By the end of this course, students should understand the fundamental concept of atomic theory, chemical equations, thermochemistry and hands-on laboratory works.

Course content: 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.

Calculus I (course type: required; course code: MTH 101)

Course objective: At the end of this course students are expected to have a clear understanding of the ideas of Calculus as a solid foundation for subsequent courses in mathematics and other disciplines as well as for direct application to real life situations.

Course content: 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

Engineering Drawing I (course type: required; course code: ECC 103)

Course objective: The aim of this course is to provide students with the basics of AutoCAD, be able to transform data into graphical drawings and also draw orthographic projections and sections, Learn basic engineering drawing formats.

Course content: Introduction to CAD. Principles of engineering drawing (1st and 3rd angle orthotropic projections), drawing methodology stages, line work 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.

English II (course type: required; course code: ENG 102)

Course objective: This course aims to take students to intermediate advanced level of English.

Course content: This course will be a continuation of ENG 101, with greater emphasis on student autonomy, research skills and synthesizing ability. All the activities and tasks in ENG 101 will continue within a thematic approach. In Eng-102, the ability to evaluate, analyze and synthesize information in written discourse will be highlighted. Documentation in writing will be introduced at the beginning of the course, in order to solidly establish the skill by the end. Students will learn the discourse patterns and structures to be used in different essay types. Students will write two essays in ENG-102. 1. An academic essay with proper documentation. 2. A project report to be prepared throughout the course, including a literature review (displaying analysis/synthesis skills, and documentation), a definition/elaboration of a problem (using definition, description, cause/effect and comparison/contrast patterns) and suggestions for solution (including personal views and argumentation). Local and regional topics, personalizing the research and viewpoints will be recommended to prevent plagiarism. Instructors will have to keep in close contact with the students to guide them throughout the process

General Physics I (course type: required; course code: PHY 101)

Course objectives: The objective of this course is to provide students with a thorough understanding of the basic concepts of physics, rigorous description of physical phenomena and to improve students' problem-solving abilities.

Course content: 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.

Calculus II (course type: required; course code: MTH 102)

Course objectives: This course aims at helping students further develop their problem solving and critical reasoning skills and to prepare them for further study in mathematics, the physical sciences, or engineering.

Course content: 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.

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Engineering Drawing II (course type: required; course code: ECC 013)

Course objectives: The aim of this course is a further development of the technical drawing abilities of the students and this is achieved through the practice and understanding of the course content.

Course content: 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

General Physics II (course type: required; course code: PHY 102)

Course objectives: General Physics II is the second part of General Physics I. The aim of this course is to help students apply knowledge of physics everyday life activities and through problem solving exercises in the fileds of Electrical and Electromagnetics point of view.

Course content: 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.

Introduction to Computers and Programming (course type: required; course code: ECC 101)

Course objectives: The goal of this course is to help students know program language evolution and classification and basic computer architecture. Students will be able to solve basic numerical computation in binary, design and implement simple assembly language programs at the end of the course.

Course content: An introduction to fundamental concepts. Algorithms and flowcharts as tools of program design process. Basic program structure. Input/output statements. Control structures: Selection and repetition statements and arrays. Concept of modular programming: Procedures and Functions.

YEAR 2

Differential Equations (course type: required; course code: MTH 201)

Course objectives: Upon completion of this course, the student should be able to apply differential equations in real life and physical phenomena, this is achieved by knowing the three methods of learning differential equations; analytic, geometric and numerical methods.

Course content: 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

English Communication Skills (course type: required; course code: ENG 201)

Course objectives: The main aim of this course is to help students improve their spoken English and also improve their communication skills.

Course content: The main goal of ENG 210 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. ENG 210 will use an integrated, thematic approach with emphasis on advanced oral communication and academic presentation skills, with language components such as grammar, vocabulary and pronunciation. ENG 210 will be inter-active; students will be encouraged to listen actively, respond to presentations, and participate in discussions. Speaking activities and academic presentations will ensue from reading and listening activities. Each theme will lead to the production of an oral and/or written activity. Input on oral presentation skills will enable the students to distinguish between oral and written discourse, and emphasize the requirements of oral discourse (such as direct sentences, transitional words and signposts). Skills (such as good body language, effective eye contact and voice control) related to the delivery of an oral presentation will be discussed and demonstrated.Active listening will be integrated into the course, with various tasks such as note-taking and peer evaluation

Statics (course type: required; course code: ECC 206)

Course objectives: Upon successful completion of this course, students will be able to formulate appropriate strategies for solving problems in engineering statics and show appropriate engineering interpretation of terms used in the physical models.

Course content: 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.

Workshop Training (course type: required; course code: AUE 200)

Course objectives: The objective of this course is to introduce students to the practical world of automotive engineering.

Course content: Students of automotive engineering will spend at least working 10 days 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.

Dynamics (course type: required; course code: ECC 212)

Course objectives: At the end of this course, students will know the basics concepts of dynamics and relate the kinematics of particles and rigid bodies to the solution of dynamics problems in straight line and curvilinear motion.

Course content: 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

Thermodynamics I (course type: required; course code: ECC 207)

Course objective: The objective of this course is to introduce the basic principles of thermodynamics via real-world engineering examples, to show students how thermodynamics is applied in engineering practice

Course content: 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.

Thermodynamics II (course type: required; course code: ECC 208)

Course objective: Providing fundamental background of thermodynamics principles and develop analytic ability in real-world engineering applications using thermodynamics principles.

Course content: 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.

Basic Electrics and Electronics (course type: required; course code: AUE 205)

Course objective: This course provides comprehensive idea about circuit analysis, electronics, working principles of machines and common measuring instruments

Course content: Introduction. Principles of electrical and electronic engineering, basic definitions and electrical circuits. Electronic components and circuits, diode and transistor circuits, power supplies. Digital circuits and systems, memory and microprocessor concepts. Power supplies and power electronics, power control circuits.

Strength of Materials (course type: required; course code: ECC 213)

Course objective: To provide knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems

Course content: 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.

Manufacturing Technology I (course type: required; course code: ECC 209)

Course objective: Students who take this course will gain a basic understanding of manufacturing systems management, including work organization, work measurement, basic scheduling mechanisms, and current theories of manufacturing management.

Course content: 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

Engineering Materials (course type: required; course code: ECC 211)

Course objective: This course intends to teach the basics and applications of stress, strain, and material properties. Understand the behavior and properties of linear elastic materials.

Course content: Materials and properties. Atomic structure and interatomic bonding, crystal structure, crystal imperfections, solid solutions. Mechanical properties of materials, elastic and plastic deformation. Behavior 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.

Mathematics For Mechanical Engineers (course type: required; course code: MTH 214)

Course objective: This course intends to gives automotive engineers convenient access to the essential problem solving tools that they use each day.

Course content: Matrix Algebra, Vectors in 2D-Space and 3D-Space, Eigenvalues, Eigenvectors, Fourier Series, Partial Differential Equations, Applied Probability and Statistics.

YEAR 3

Industial Training (course type: required; course code: AUE 300)

Course objective: The aims to give meaning to education by relating training to specific occupational goals. In the process it will develop ability, understanding, attitudes, work habits and an appreciation of the meaning of work, as necessary contributions to successful employment.

Course content: 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 will spent 20 working days in a factory related with automotive industry and develop themselves on manufacturing techniques, factory organization, costing, management and quality control. 10 working days will be spend in an authorized technical service. At the end of the training students will be required to complete a report regarding their training.

Numerical Analysis (course type: required; course code: MTH 323)

Course objective: The aims are to learn about existence and uniqueness criteria for numerical methods, to learn about convergences criteria and to be aware of reasons why numerical methods may fail.

Course content: 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.

Fluids Mechanics (course type: required; course code: ECC 304)

Course objective: The aims are to give appropriate fluids properties and show how these allow differentiation between solids and fluids as well as between liquids and gases.

Course content: 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, External incompressible viscous Flow.

Theory of Machines I (course type: required; course code: ECC 309)

Course objective: The aims are to introduce students to design with machine elements; to teach principles and functions of mechanical components; to provide familiarity with machine shop operations through lab sessions.

Course content: 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.

Machine Design I (course type: required; course code: ECC 307)

Course objective: The aims are to give the students the knowledge of theory of machines and strength of materials.

Course content: 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

Machine Design II (course type: required; course code: ECC 308)

Course objective: Students will learn current engineering methods used in the design and selection of machine components.

Course content: Analysis and design of machine elements. Helical, bevel and worm gears. Shafts and associated parts, keys, pins, splines, couplings, clutches, brakes and fly wheels, belts, chains, torque converters. Design project involving a mechanical component or device including all detail drawings, assembly drawings and cost analysis.

Introduction to Automotive Engineering (course type: required; course code: AUE 305)

Course objective: The aims are to give the students introduction to automotive engineering and its application in professional practice. Includes design, analysis, testing and dissection of automotive engineering systems.

Course content: Introduction to automotive engineering. Definition of components of a vehicle. Components of an engine and gear box. Steering wheel suspension systems, brakes, body and the wheels. Vehicle performance calculations: Power, speed and acceleration, clutch dynamics, brakes and fuel consumption. Vehicle production and material selection. Alternative vehicle terminologies. Automotive engineering and environmental aspects. Vehicle test principles.

Vehicle Component Design (course type: required; course code: AUE 306)

Course objective: The course is intended to show the design of ground vehicles for directional stability and control. Tire mechanics and their effects on vehicle performance.

Course content: Chassis and power transmission systems design. Gear box, vehicle handling performance data, vehicle design standards. Forces acting on vehicles and engine performance calculations. Planetary gear trains: Speed graphs and moments. Manual and automatic transmission and components design. Crank shaft, clutch and components. Chassis components design: wheels, brakes, suspension and steering systems. Students are required to complete one design project.

Control Systems (course type: required; course code: ECC 310)

Course objective: The course is intended to supply the students with the foundations of modern industrial control.

Course content: Introduction to automatic control. Mathematical modeling of dynamic systems. Response analysis using Laplace transform method. Transfer functions and block systems. Feedback control systems. Typical actuators and transducers. Control law.

Manufacturing Technology II (course type: required; course code: ECC 305)

Course objective: The course is intended to provide a broad introduction to all types of manufacturing processes.

Course content: 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.

Heat Transfer I (course type: required; course code: ECC 316)

Course objective: The course is intended to provide students with the working knowledge required to formulate and analyze problems in energy transfer via heat and to take this knowledge on for application in other junior and senior level courses.

Course content: 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.

YEAR 4

Graduation Project (course type: required; course code: AUE 400)

Course objective: The course is intended to evaluate students ability to complete a project without a given detailed structure usually found in undergraduate courses

Course content: Design or research projects are assigned including application and synthesis. The projects including prototype production are especially encouraged. Students may work alone or as a team. Supervisors and jury members grades the projects by considering the studies during the semester, project report and presentation.

Vehicle Dynamics (course type: required; course code: AUE 401)

Course objective: The course is intended to familiarize the students with the basic mechanisms of machines used in industries. Also belt & rope drives, gears etc. will be taught for the knowledge of various machine parts.

Course content Driving and road handling in vehicles. Motion in longitudinal, transverse and perpendicular directions. Tire and wheel fundamentals. Effects of design changes on driving stability and road handling. Stable and unstable road handling. Steering system. Slip angle and steering wheel effect. Low and over steering. Driving characteristics of four wheel drive vehicles. Vehicle ride models. Analytical vehicle and road models.Statistical driving characteristics. Driving quality measures. Classification and analysis of suspension systems: Active and passive suspension systems.

Vehicle Body Design (course type: required; course code: AUE 403)

Course objective: The aims to provide sound knowledge in concept design and production body design. The subjects covered in concept design are product planning and research.

Course content: Design of vehicle body and material selection. Vehicle development conditions and planning. Design against bending, torsion and cyclic loading. Design philosophy and ergonomics. Crash test, analysis and simulation accidents. Active and passive security systems. Topology, material selection, limiting conditions for packaging and manufacturing. CATIA software, 3D modeling, technical drawings and finite element analysis. A design project will be assigned to students

Vehicle Production Processes and Systems (course type: required; course code: AUE 404)

Course objective: The aims to provide consolidating students understanding of production processes and strategies in practices.

Course content: Introduction to vehicle production systems. Manufacturing techniques used in Automobile industry. Vehicle body production. Manufacturing techniques of sheet metal automobile parts. Painting and coating. Assembly: Cabinet, chassis and engine. Vehicle parts production systems: electrical and electronic systems. Transmission. Industrial and sub-industrial production, logistics, optimization of production systems.

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Experimental Analysis of Mechanical Engineering Systems (course type: required; course code: AUE 424)

Course objective: The aims to develop the student's skills in testing, measuring procedures, and knowledge of the concepts of experimental engineers for automotive systems.

Course content: 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.

.**International Combustion Engines (course type: required; course code: ECC 425)**

Course objective: The aims to show the variation of basic engine characteristics under different engine loading conditions.

Course content: 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

Management for Engineers (course type: elective; course code: ECC 427)

Course objective: The aims to develop a thorough understanding on management and budgeting principles.

Course content: Principles of management. Functions of managers. Organization and environment.Marketing management.Production management. Personnel management. Managerial control. Accounting and financial reports. Budgeting and overall control.

Economics for Engineers (course type: elective; course code: ECC 426)

Course objective: The aims to use the basic financial tools required for sound decision making in engineering and performing some cash flow calculations in engineering projects.

Course content: 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.

Transmission Systems (course type: elective; course code: AUE 411)

Course objective: The aims are to give introduction to vehicle transmission systems, components of automotive and automotive engines types and construction.

Course content: Review of basic gear theory: types of gears, gear wear, bearings, basic gear adjustments, gear trains and transmission. Drivetrain: engine, transmission, transmission gears, final drive and differential. Gearbox requirements. Manual, dual clutch and automatic transmission. Transmission electronics and mechatronics, gear shifting, AWD systems and torque vectoring, component design, optimization and manufacturing. Gearbox lubricants and hydraulic components. Alternative drive trains and transmissions. Final drive and differential assembly design.

Fuel Cells (course type: elective; course code: AUE 421)

Course objective: The aims are to give background understanding of electrochemical principles and interpret the mechanisms of a fuel cell.

Course content: Basic electrochemical principles. Thermodynamics of fuel cell systems. Performance characteristics: efficiency and open circuit voltage. Operating fuel cell voltages. Classification of fuel cells. Examples of fuel cells. Fuel cell fuels. Storage in vehicles. Fuel cell modeling. Production techniques and materials. Simulation of vehicles with fuel cells.

Internal Combustion Engine Design (course type: elective; course code: AUE 422)

Course objective: The aims are to give a fundamental knowledge on the thermodynamics of internal combustion engines and improving engine design technology.

Course content: Engine Maps. Engine development process. Engine types. Cylinder block and head design. Engine bearing design. Sealants and gasket design. Pistons and rings. Crankshaft, connecting rods, camshaft, valves and valve gear design.

Electronic Systems in Vehicles (course type: elective; course code: AUE 431)

Course objective: The aims are to enable students to understand the vehicle wiring diagram and basics of dealing with the modern vehicle Engine Control Unit and electronic systems.

Course content: Battery, ignition systems. Starter and alternators. Light and signal systems. Klaxon, wipers, warning systems and displays. Principles of electronic control units: block diagrams, design stages. Micro-processors, switching transistors, communication protocols between electronic systems. CAN-bus system. Electronic transmission systems.

Automotive Sensors and Measurement Systems (course type: elective; course code: AUE 432)

Course objective: The aims are to enable students to understand the application and measurements of the engine sensors using computers and basics of dealing with the modern vehicle ECU and electronic systems.

Course content: Computer aided measurement systems. A/D and D/A conversion. Acceleration and braking assist systems: Linear and angular position, velocity and acceleration measurements. Sensors for engine variables. Problem and danger actuators. Sensors and actuators for other cars and objects. Auxiliary sensors

Electric and Hybrid Vehicle (course type: elective; course code: AUE 452)

Course objective: The aims are to show students alternative energy influence changes in vehicle engine and electrical systems, emission systems, and components

Course content: Electric vehicle types: Battery and battery modeling. Alternative energy sources and storage of energy: battery, flywheel, supercapacitors. Fuel cells and fuel cell applications in vehicles. Electric motors, generators, and controls. Brushed and brushless DC motors. Electric Propulsion Systems .Electric vehicle chassis and body design. Environmental impact of modern transportation

Mechatronics (course type: elective; course code: ECC 421)

Course objective: The aims are to give students necessary knowledge in using sensors, and actuators, electrical equipment and microprocessors for designing and building intelligent mechatronic systems

Course content: Introduction to Mechatronics and measurement systems. Sensors and transducers: Sensors and transducers, Performance terminology, Examples of sensors, Selection of sensors. Signal conditioning: Signal conditioning, The operational amplifiers for analog signal processing,

Protection, Filtering, Digital circuits and systems. Measurement systems: Designing measurement systems, Data presentation systems,Measurement systems, Testing and calibration. Mechanical actuation systems: Mechanical systems, Kinematic chains, Cams, Gear trains, Ratchet mechanisms, Belt and chain drives. Electrical actuation systems: Electrical systems, Switches, Solenoids, Motors, Stepping motors. Basic system models: Mathematical models, Mechanical system building blocks, Electrical system building blocks, Fluid system building blocks, Thermal system building blocks. Simulation of simple mechanical systems by electrical elements (circuits). Design and mechatronics: Designing, Mechanisms, Examples of designs.

Theory of Machines II (course type: elective; course code: ME 403)

Course objective: The aims are to introduce students to advance design with machine elements; to teach principles and functions of mechanical components.

Course content: 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 Initial Excitations, Response of Single-Degree-of-Freedom Systems to Harmonic and Periodic Excitations, Vibration Control, Critical Speed of Shaft, Rotor Balancing.

Refrigeration Techniques (course type: elective; course code: ME 418)

Course objective: The aims are to introduce students to the safe methods of defrosting and draining of condensate water from evaporator surfaces.

Course content: 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.

Heat Exchanger Design (course type: elective; course code: ME 423)

Course objective: To introduce seniors in Automotive Engineering, an ability to integrate basic heat transfer, fluid mechanics and engineering thermodynamics knowledge into overall design and performance evaluation of various types of heat exchangers.

Course content: 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.

Introduction to Finite Element Method (course type: elective; course code: ME 426)

Course objective: The objective of this course is to teach in a unified manner the fundamentals of the finite element method for the analysis of engineering problems arising in solids and structures

Course content: 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.

Computer Aided Design (course type: elective; course code: ME 429)

Course objective: The aims are to enable the student to know how to design, analyze and present various problems encountered in the field of mechanical engineering with enough accuracy and speed by the aid of the computer.

Course content: 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.

Computational Fluid Dynamics (course type: elective; course code: ME 443)

Course objective: The aims are to enable the student to study, analyze and present various problems in the field of thermofluids by the aid of various computer software.

Course content: Numerical solutions of basic conservation equations of fluid dynamics. The basis of the numerical solution techniques. Finite volume method. Boundary conditions. Turbulance and heat transfer models. Multi phase flows and introduction to the flows with chemical reactions

Advanced Strength of Materials (course type: elective; course code: ME 451)

Course objective: The aims are to enable the student to analyze the materials strength and stress.

Course content: Fundamental concepts and elementary elasticity. Review of failure theories. Nonsymmetrical bending of beams. Torsion of noncircular long prisms. Elastic stability and buckling of columns. Selected topics among energy methods, limit analysis, beam-columns, thermal and residual stresses

Materials Engineering (course type: elective; course code: ME 453)

Course objective: The aims are to give the student a sound background in the science of engineering materials diagram selections.

Course content: Engineering materials and properties.Material selection and material improvement. Heat treatment and examples. Advanced materials. Design with brittle material. Weibull analysis. Material selection diagrams.

Heat Treatment (course type: elective; course code: ECC433)

Course objective: The aims are to make students aware of the fact that desirable mechanical and other material properties in engineering materials can be achieved by a proper heat treatment design and practice.

Course content: The relation between material structure ↔ production technique ↔ material properties in engineering materials. Heat Treating of Steel - quenching, tempering and annealing, continuous annealing, quantitative methods to predict hardenability. Heat treating information for the most widely-used nonferrous alloys, cast iron, ceramics and glass.

Quality Control (course type: elective; course code: ECC434)

Course objective: The aims are to make students to be able to compare the quality, quality control, and the assurances.

Course content: Quality applications, procedures, techniques, and strategies. How to plan for quality, achieve quality control, and ensure quality results Measurement. Tolerances. Error analysis. Calibration. Quality assurance systems: ISO 9000 and the total quality management. Statistics in quality control. Sampling techniques. Quality tables

Neural Networks (course type: elective; course code: ECC404)

Course objective: Teaching the basics of neural networks. To illustrate the basic applications of neural networks using Matlab. To give the principles of neural networks approaches

Course content: Introduction to Neural Networks; definitions, history, analogy to biological brain. Neural Networks architecture and learning methods; Hebb's theory, Supervised/Unsupervised Learners; the Perceptron, Hamming network, Hopefield network, Kohonen self-organising network, competitive learning, Back propagation algorithm. Neuron activation functions. Adaline network and XOR-Problem. Training by error minimization. Feedback and Recurrent networks. Mathmatica and MATLAB Software used for neural network simulation during laboratory work.

Image Processing (course type: elective; course code: ECC419)

Course objective: Teaching the basics of image processing; To illustrate the basic applications of image processing using Matlab. To give the principles of image enhancement approaches

Course content: Mathematical model of image. Image acquisition, sampling and quantizing. Enhancement and restoration of image. Image coding and compression techniques. Image recognition. Practical aspects of image processing.