Faculty of Engineering, Mattaria

PROGRAM REQUIRMENTS AS PER BYLAWS 2020 FOR

AUTOMOTIVE MECHATRONICS ENGINEERING PROGRAM

[2020]

Declaration

This program content is extracted from Faculty of Engineering –Mataria- Helwan, University approved bylows in Year 2020.

The study courses are taught in English language as all reference books and notes are in English.

Tables of University and Faculty Requirements Compulsory and Elective Courses

University Requirements (13 credits)

Course Code	Course Title	Pre-requisites	Cr. hr.	Contact Hours			
				Lec.	Tut	Lab	∑
HUM001	History of Engineering and Technology		1	1			1
HUM002	Human Rights		1	1			1
HUM003	Report Writing		2	2			2
HUM004	Communication and Presentation Skills		2	2			2
HUM101	Technical English Language		1	1			1
HUM201	Environment and Pollution Sciences		2	2			2
Total			9	9	0	0	9

Course Code	Course Title	Pre-requisites	Cr. hr.	Contact Hours			
				Lec.	Tut	Lab	∑
HUM121	Research and Analysis Skills		2	2			2
HUM122	Negotiation Skills		2	2			2
HUM123	Marketing		2	2			2
HUM124	Professional Ethics		2	2			2
Total			4	4			4

College requirements (32 credits)

Course Code	Course Title	Pre-requisites	Cr. hr.	Contact Hours			
				Lec.	Tut	Lab	∑
BSE001	Engineering Mathematics-1		3	2	2		4
BSE002	Engineering Mathematics-2		3	2	2		4
BSE003	Physics-1		3	2		3	5
BSE004	Physics-2		3	2		3	5
BSE005	Engineering Mechanics-1		2	1	2		3
BSE006	Engineering Mechanics-2	BSE005	2	1	2		3
BSE007	Chemistry		3	2		3	5
BSE008	Eng. Drawing and Projection with PC		3	2		3	5
BSE101	Numerical Analysis	BSE002	3	2	2		4
BSE202	Modelling & Simulation	BSE101	3	2	2		4
BSE201	Engineering Economics	BSE002	2	2			2
Total			30	20	12	12	44

Course Code	Course Title	Pre-requisites	Cr. hr.	Contact Hours			
				Lec.	Tut	Lab	∑
BSE122	Engineering Mathematics-3	BSE002	2	1	2		3
BSE123	Physics-3	BSE004	2	1		2	3
BSE124	Applied Statistics in Engineering	BSE002	2	1	2		3
BSE221	Mech. and Elec. Utilities		2	1	2		3
BSE222	Accounting	BSE002	2	1	2		3
Total			2	1	2		3

Content of University Requirement Compulsory Course

Course Code: HUM001 History of Engineering and Technology
Contact Hours: 1 Lec. – 0 Tut. – 0 Lab., (1 Cr. hr.)
Course Content
Definitions: technology, technical sciences, Engineering sciences – Technology and engineering development – Engineering relationships between science and technology – Major milestones in mechanical, architectural and structural engineering – Examples on development of different engineering activities.
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Course Code: HUM002 Human Rights
Contact Hours: 1 Lec. - 0 Tut. - 0 Lab., (1 Cr. hr.)
Course Content
Legal system of human protection rules – The idea of human rights in Pharaonic Egypt and the heavenly religions and modern times – Human rights sources – The characteristics and principles of human rights – Types of human rights – anti-Corruption – The concept of corruption – Types and source of corruption – Causes of corruption – Effects of corruption.
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Course Code: HUM003 Report Writing
Contact Hours: 2 Lec. – 0 Tut. – 0 Lab., (2 Cr. hr.)
Course Content
Objectives, background, method, results, Techniques of report writing: organization - conclusions, appendices, etc.. Achieving clarity and conciseness- Start of Writing - page design - presentational aspects - figures, graphs, tables, literature references, etc .. Other forms of writing articles, letters, brochures, posters, CV.
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Course Code: HUM004 Communication and Presentation Skills
Contact Hours: 2 Lec. – 0 Tut. – 0 Lab., (2 Cr. hr.)

Course Content
Human behavior analysis – communication skills – The relation between human motivation and human behavior in communications–Encouragement methods to achieve effective communication – effective listening skills – effective oral skills – Culture categories and their effect on personal communication – Oral and body langue analysis for dealers – prediction and brain analysis skills – Satisfaction and convincing skills – Refuse and objection treatment to solve different opinion problems – brain control methods in personal communication - Preparation of technical presentation (objective – introduction – method – analysis – results – conclusion) – preparation of visionary matter – time interval of presentation – technical method of presentation – choosing suitable presentation facility – preparation to answer questions – other aspects of presentation skills like speech and meeting.
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Course Code: HUM101 English Technical Language
Contact Hours: 1 Lec. – 0 Tut. – 0 Lab., (1 Cr. hr.)
Course Content
Review of grammar, statement, and paragraph construction. – Technical Engineering Terminologies related to study specialties - Exercises related to scientific topics – Developing student capabilities of understanding and interpretation –exercises on writing of technical topics – readings in scientific books.
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Course Code: HUM201 Environment and Pollution Sciences
Contact Hours: 2 Lec. – 0 Tut. – 0 Lab., (2 Cr. hr.)
Prerequisites:

Course Content
Introduction to environmental sciences - Sources of environmental pollution (Air, water, and soil) - Environment & Development - Environmental services project such as paving road, improving water supplies & facility sustaining - Evaluation of environment effects for industrial projects - Laws and regulations of the environment.

Content of University Requirement Elective Courses

(Only 4 Credit Hours are required)

Course Code: HUM121 Research and Analysis Skills
Contact Hours: 2 Lec. – 0 Tut. – 0 Lab., (2 Cr. hr.)
Prerequisite:
Course Content
Introduction and Basic Research Concepts – Qualitative Research Methods – Quantitative Research Methods and Statistics – Mixed Methods Research – Reporting Results of Data Analysis – Completing the Research Project.

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Course Code: HUM122 Negotiation Skills
Contact Hours: 2 Lec. – 0 Tut. – 0 Lab., (2 Cr. hr.)
Prerequisites:
Course Content
Principles, Attributes, Strategies & Tactics of Negotiations – Developing abilities & Skills for good preparation & Practices of Negotiation in contemporary Organizations – Negotiation concept, principles, Interdependence – Ethics of negotiation, psychological & social aspects – Cooperative and Competitive Negotiation – Good preparation of Negotiation – Organizing Negotiation – Using power in Negotiation – Using questions and dealing with objections- Handling failure in Negotiation – Best practices.

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Course Code: HUM123 Marketing
Contact Hours: 2 Lec. – 0 Tut. – 0 Lab., (2 Cr. hr.)
Prerequisites:
Course Content
Introduction to sales, strategic sales force management, personal sales process and sales force system, how to recruit sales representatives, selection and recruitment of applicants, sales program development, sales force stimulation, sales force bonuses, transportation expenses, sales force leadership, sales forecasting and budget development, sales territories , Sales volume analysis, marketing cost, profitability analysis, performance appraisal, professional and legal responsibilities and ethics in bidding writing.

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Course Code: HUM124 Professional Ethics
Contact Hours: 2 Lec. – 0 Tut. – 0 Lab. (2 Cr. hr.)
Prerequisites:
Course Content
Introduction to governing laws (general rules – goals – principles – sources) – contracts (nature – types – components) – commercial laws – companies and contract laws – tenders laws – general laws for mechanical engineering (taxes – environmental – industrial– laws of urban planning & public works –Syndicates - Consumer Protection Laws – traffic and roadway laws.

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Content of Faculty Requirement Compulsory Courses

Course Code: BSE001 Engineering Mathematics-1
Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 cr. hr.)
Prerequisites:
Course Content

Calculus: Inverse trigonometric functions (derivatives – integrals) – Hyperbolic and inverse hyperbolic functions (derivatives – integrals) – Logarithmic differentiation – L'Hopital's rule – Sequence – Series (special series & partial sum) – Integration by substitution – Integration by parts – Integration by reduction formulas –Integrations of powers of trigonometric/hyperbolic functions – Integrations of fractions including trigonometric functions – Integrations by removing roots – Integrations by partial fractions – Applications of definite integral (arc length – surface area) – Functions of several variables (partial differentiation) – Engineering mathematical models – Classification of differential equations – Solution of first order ordinary differential equations ODE (separable – homogenous – exact – linear – Bernoulli).

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Course Code: BSE002 Engineering Mathematics-2
Contact Hours: 2 Lec. - 2 Tut. - 0 Lab. (3Cr. hr.)
Prerequisites:
Course Content

Calculus: Function of several variables (chain rule – increment and differential – implicit differentiation – local and absolute extreme values – Lagrange multipliers) – Solution of higher order ODE (undetermined coefficients – variation of parameters – Cauchy-Euler ODE) – Series (positive term tests – power series – Taylor and Maclaurin series).

Algebra and Analytic Geometry: Theory of equations (Synthetic division, relations between roots and coefficients, reciprocal equation, transformation of algebric equations, Caradan's and Ferrari's methods) – Linear system (Gauss elimination and Gauss-Jordan) – Eigenvalues and Eigenvectors of square matrix – Classification of conic sections (circle, parabola, ellipse, and hyperbola) – Classification of surfaces (sphere, ellipsoid, paraboloids, hyperbolids, cylinders, and cones).

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Course Code: BSE003 Physics-1
Contact Hours: 2 Lec. - 0 Tut. - 3 Lab., (3 cr. hr.)
Prerequisites:
Course Content

Properties of matter: Elastic properties of materials, Hook's Law and its applications, Hydrostatics and surface tension, Hydrodynamics.

Heat and Thermodynamics: Temperature and Zeroth law of thermodynamics, Equation of state of an ideal gas, Heat, Phase change properties of pure substance, Kinetic theory of gases, Equipartition theory of Energy and degree of freedom, Work and Energy conservation principle, First law of thermodynamics and its applications on thermal processes, Thermodynamics cycles and Enthalpy, Heat transfer by conduction

Experiments (Lab)

Hook's Law	Simple Pendulum
Velocity of Sound in air	Coefficient of Thermal Expansion
Melting Temperature of Wax	Electrical Equivalent of Heat

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Course Code: BSE004 Physics- 2
Contact Hours: 2 Lecture - 0 Tutorial - 3 Lab, (3Cr. hr.)
Prerequisites:
Course Content

Electricity: Electric Charge and Coulomb's Law, Continuous charge distribution, Electric field due to point charge, Electric field due to continuous charges distribution, Electric Flux, Gauss's Law and its Applications, Electric potential, Capacitors and dielectrics, Introduction to semiconductors, Simple circuit analysis.

Electromagnetism: Magnetic field, Magnetic force, Biot – Savart Law, Ampere's law, Electromagnetic induction and Maxwell's equations.

Experiments (Lab)

Ohm's Law.	Non – Ohmic Materials.
Resistors in Series and in Parallel.	Transient Phenomena in RC Circuit.
Coulomb's Law.	Current Balance.

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Course Code: BSE005 **Engineering Mechanics-1**
Contact Hours: 1 Lec. – 2 Tut. – 0 Lab., (2 cr. hr.)
Prerequisites:

Course Content

Vectors applications: force representation in three dimensions-vectors algebra - equivalent force resultant.
Equilibrium: equilibrium of a particle in three dimensions - equilibrium of a rigid body in three dimensions - frames - determination of the force in a trusses by joint and sections methods.
Friction: belt friction - wedge friction - tipping and slipping.
Properties of area: the first moment of area – area moment of inertia – parallel axes theorem – radius of gyration.

Experiments (Lab)

HOOKE'S law—Measuring forces.	Resolving forces—Components.
Adding forces - Resultants & equilibrants.	Torque—Parallel forces.
Equilibrium of physical bodies.	Center of mass.
Siding friction.	

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Course Code: BSE006 **Engineering Mechanics-2**
Contact Hours: 1 Lec. - 2 Tut. – 0 Lab., (2 Cr. hr.)
Prerequisites: BSE005

Course Content

Kinematics of a particle: Kinematics of rectilinear and curvilinear motion-motion of Projectiles-Natural coordinates (Normal and tangential)-polar coordinates-cylindrical coordinates- coordinates transformations.
Kinetics of a particle (Force and acceleration): Kinetics of rectilinear motion- Kinetics of curvilinear motion using different coordinates (Natural- cylindrical- polar).
Kinetics of a particle (Work and energy): types of different energy-work and energy principle-conservation of energy-power

Experiments (Lab)

Instant speed.	Acceleration on inclined surfaces.
Dynamic friction.	Kinetic energy.

Kinetics of rigid body (2nd Newton's law)

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Course Code: BSE007 **Engineering Chemistry**
Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)
Prerequisites:

Course Content

STATES of MATTER & GASEOUS STATE: Factors affecting gas behavior. Gas laws; Ideal gas. Gas mixtures. Real gas, intermolecular forces. Liquefaction of gases.
COMBUSTION: Factors affecting combustion, excess air, flue gas, air to fuel.
ELECTROCHEMISTRY and METALLIC CORROSION: Galvanic cells, Daniel cell, cell diagram and spontaneous redox reactions. Electrode potential, hydrogen electrode, standard electrode potentials and electrochemical series. Electrode potential under non-standard conditions. Galvanic cell applications, fuel cells.
CORROSION: Corrosion reactions - Affecting parameters. High temperature corrosion – Protection – Galvanic corrosion - Stress corrosion - Passivity of metals – Oxide film Nature – Protection against corrosion techniques.
WATER: Hardness of water, types and units - Measurement - Removal - Calculation. Boiler feed water - scale and sludge formation - Boiler corrosion. Drinking water, standards and treatment - Treating saline water - Reverse osmosis.
POLLUTION: Sources of pollution – Types – control – Dispersion - Economical control - Waste recovery.

CEMENT: Raw materials; cementing materials - Manufacture cement - Chemical reactions - Setting and hardening - Types of cement - regular Portland - sulfate resisting - rapid hardening - white Portland - high alumina - oil-well cement - Decay of cement concrete.
CERAMICS: Definition – properties – importance – Manufacturing - Raw materials – types - structural clay ceramic – Refractories - Special ceramic.
POLYMERS: Classification - Properties – Plastics – Rubber - Conducting polymers - Polymer concrete.
Experiments (Lab.)
1-Qualitative chemical analysis
2- Quantitative analysis
3- Water analysis

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Course Code: BSE008 Engineering Drawing and Projection with PC
Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)
Prerequisites:
Course Contents
Principles of engineering drawing using paper and pencil – hand skills in engineering drawing – prediction of projections – Principles of drawing and graphics using computer programs (Auto CAD or Solid Works). Theories of engineering projection: projection of point, lines, plan, and geometrical bodies. Projection by auxiliary plans. Intersection of surfaces and bodies. Development the surfaces of engineering bodies. Basic rules to write dimensions. Obtaining of missing view from given two views. Isometric and oblique drawings. Types of sectioning Views. Draw of steel construction.

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Course Code:BSE101 Numerical Analysis
Contact Hours: 2 Lec. + 2 Tut. + 0 Lab. (3 Cr. hr.)
Prerequisites: BSE002
Course Content
Solution of Equations by Iteration - Linear Systems: Gauss Elimination; LU-Factorization; Matrix Inversion; Solution by Iteration – Numeric Integration and Differentiation – Interpolation and curve fitting - Conditioning Norms - Matrix Eigenvalue Problems - Methods for First-Order ODEs - Methods for Elliptic PDEs.

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Course Code: BSE2٠2 Modeling and Simulation
Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 Cr. hr.)
Prerequisites: BSE101
Course Content
Introduction to Dynamic Systems – Modeling Mechanical Systems – Modeling electrical and electromechanical systems – Modeling of fluid systems – Modeling of Thermal Systems – Standard models for dynamic systems – Numerical simulation of dynamic systems - Analytical solution of linear and nonlinear dynamic systems.

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Course Code: BSE201 Engineering Economics
Contact Hours: 2 Lec. – 0Tut. – 0 Lab. (2 Cr. hr.)
Prerequisites: BSE002
Course Content
The decisions of the engineer and the economy – The economic variables in technical selections – Temporary equivalence of capitals – Financial Mathematics – Present Worth Models (PV) – Annual Cash Flow Models – Rate of Return Analysis – Incremental analysis – Other analysis Techniques – The uncertainty in the election – Depreciation – Fiscal Effects – Replacement Analysis – Effects of the inflation – Selection of the suitable rate of discount – CB Analysis in the public sector – Rationing limited financial resources between projects – The Accounting information as a source for engineering decisions – The models of project evaluation in the very long run

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Content of Faculty Requirement Elective Courses

(Only 6 credit hours are required)

Course Code: BSE122 **Engineering Mathematics–3**
Contact Hours: 1 Lec. – 2 Tut. – 0 Lab., (2 Cr. hr.)
Prerequisites: BSE002
Course Content:
Advanced Calculus: Power series solution of ODE – Laplace transform (Basic definitions and theorems) – Inverse Laplace transform – Applications of Laplace transform (solution of ODE – solution of integral-differential equations - solution of system of ODE's) – Solution of system of ODE's by Eigenvalues and Eigenvectors – Double and triple integrals (polar shapes – Engineering applications) – Vector function (vector differential operator – gradient – divergence – curl – directional derivative) – Line integral – Independence of path – Green's theorem – Surface integral – Gauss theorem – Stokes' theorem.

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Course Code: BSE123 **Physics–3**
Contact Hours: 1 Lec. – 0 Tut. – 2 Lab., (2 Cr. hr.)
Prerequisites: BSE004
Course Content:
Wave and vibrations: Harmonic vibrations in mechanical and electrical systems, Geometric representation, Damped vibration, Forced Vibration, Wave Motion, Types of waves, Wave equation and Interference, Wave velocity, Standing waves, Velocity of sound wave in fluids, Wave measurements Doppler effect.
Electromagnetic waves and Optics: The nature of light and the principles of ray optics, Reflection of light, Refraction of light, Index of refraction, Image formation, Mirrors, Lenses and its applications.

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Course Code: BSE124 **Applications of Statistics in Engineering**
Contact Hours: 1 Lec. –2 Tut. –0 Lab. (2 Cr. hr.)
Prerequisites: BSE002
Course Content
The role of statistics in engineering – descriptive statistics - probability - discrete random variables and probability distributions - continuous random variables and probability distributions - joint probability distributions - random sampling and data description - point estimation of parameters - statistical confidence intervals for a single sample - building regression models - tests of hypotheses for a single sample - analyzing engineering experiments, and statistical process control.

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Course Code: BSE221 **Mech. and Elec. Utilities**
Contact Hours: 1 Lec. – 2 Tut. – 0 Lab., (2 Cr. hr.)
Prerequisites:
Course Content
Mechanical Installation of pipelines, all valves, metal structure for the industrial institutions, all kinds of pumps, firefighting systems, equipment and devices used in the industrial process, air systems. Tests and preparations before starting operating the equipment and devices in the industrial institutions.

Electrical Installation: electrical transformers base on the international standards, lighting system, lightening protection systems, cables tray and its accessories, control panels with engines, SCADA systems, measuring devices, firefighting alarm systems, communications systems, and low potential distributing panels that concerns the new residential areas.

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Course Code: BSE222 **Accounting**
Contact Hours: 1 Lecture - 2 Tutorial - 0 Lab, (2 cr hr.)
Prerequisites: BSE002

Course Content

Business Environment; Forms of business organization; Introduction to accounting: information systems, the use of the Accounting Equation.; Accounting conventions and their use in the preparation of financial statements; Accruals, Prepayments and Depreciation The analysis and interpretation of financial statements using ratios; Financial planning and control. Dividend Payout policy and Capital Structure.; The valuation and appraisal of real and financial assets using DCF techniques and short term appraisal techniques including identification of relevant costs and discussion of other costing basis (direct, absorption; fixed and variable); Stock Exchange, Venture Capital and Initial Public Offerings, Merger and Acquisitions; Financial strategy and Corporate Governance. Risk and return, cost of capital, agency theory

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List of specialized courses for the Automotive Mechatronics Engineering program

Course Code	Course Title	Pre-requisites	Cr. hr.	Contact Hours			
				Lec.	Tut	Lab	∑
MDE001	Production Technology		2	1		3	4
ECE101	Electronics Engineering	BSE004	3	2		3	5
ECE002	Digital Systems Design		3	2		3	5
ECE201	Computer Programming		3	2		3	5
ECE302	Microcontrollers	ECE201	3	2		3	5
MPE100	Thermodynamics	BSE003	2	2			2
MPE103	Fluid Mechanics	BSE005	3	2		3	5
EPE101	Electrical Engineering	BSE004	3	2		3	5
MDE101	Technology and Strength of Materials		3	2	1	1	4
MDE102	Mechanical Drawing using PC	BSE008	3	1	2	3	6
MPE202	Engineering Measurements	BSE00٤	3	2		3	٥
AUT301	Automatic Control	BSE101	3	2	2		4
AUT202	Mechatronics	MPE202	3	2		3	5
MPE203	Heat Transfer	MPE100	2	1		3	4
MDE301	Mechanical Vibrations	BSE006	3	2	2		4
MPE304	Internal Combustion Engines	MPE100	3	2		3	5
EPE203	Electrical Machines	EPE101	3	2	2		4
ECE202	Introduction to Power Electronics	ECE101	3	2		3	5
MDE201	Stress Analysis	MDE101	3	2	1	1	4
AUT203	Vehicle Technology	AUT101	3	2		3	5
AUT407	Embedded Systems	ECE302	3	2		3	5
Total			60	37	12	49	96

General specialized requirements for elective courses (9 credit hours)

Course Code	Course Title	Pre-requisites	Cr. hr.	Contact Hours			
				Lec.	Tut	Lab	∑
AUT221	Computerized Maintenance Management		3	2	2		4
AUT222	Automotive Body Design and Analysis	MDE201	3	2	2		4
AUT223	Vehicle Aerodynamics	MPE103	3	2	2		4
AUT224	Operations Research		3	2	2		4
AUT225	Hydraulic and Pneumatic Control Systems	MPE103	3	2	2	1	5
AUT421	Signal Analysis	AUT202	3	2		3	5
AUT423	Spare Parts Inventory Management	AUT203	3	2	2		4
Total							

Subspecialty requirements courses (45 credit hours) Subspecialization requirements from compulsory courses (33 credit hours)							
Course Code	Course Title	Pre-requisites	Cr. hr.	Contact Hours			
				Lec	Tut	Lab	∑
AUT101	Automotive Engineering Laboratories	32 Cr. hr	1			3	3
AUT302	Automotive Electrical Circuits and Systems	AUT203	3	2		3	5
AUT303	Electric and Hybrid Vehicle Technology	AUT203	2	1		3	4
AUT304	Automotive Chassis Design	MDE201	3	2	2		4
AUT305	Automotive Fault Diagnosis	AUT203	3	2		3	5
AUT306	Performance of Electric and Hybrid Vehicles	AUT303	3	2	2	-	4
AUT401	Field Training	100 Cr Hr	2			6	6
AUT402	Vehicle Dynamics	MDE301	3	2	2		4
AUT403	Automotive Maintenance	AUT305	3	2		3	5
AUT404	Automotive Mechatronics Systems Design	AUT301	3	2	2		4
AUT405	Graduation Project -1	128 Cr Hr	3	2		3	5
AUT406	Graduation Project -2	AUT405	4	2	1	3	6
Total			33	19	9	27	55

Subspecialty requirements for elective courses (12 credit hours)							
Course Code	Course Title	Pre-requisites	Cr. hr.	Contact Hours			
				Lec.	Tut	Lab	∑
AUT226	Automotive Powertrain Systems	AUT203	2	1		3	4
AUT331	Automotive Engines Alternative Fuels	MPE304	2	2		1	3
AUT332	Automotive Air Conditioning	MPE203	3	2		3	5
AUT333	Automotive Pollution Control	MPE304	2	2			2
AUT334	Automotive Preventive Maintenance	AUT303	2	2			2
AUT335	Vehicle Energy Storage Systems	AUT303	2	2			2
AUT431	Automotive Power Electronics	ECE202	3	2	1	2	5
AUT432	Intelligent Vehicle Technology	AUT404	3	2	2		4
AUT433	Automotive Accident Analysis	AUT402	2	2			2
AUT434	Automotive Safety Systems	AUT402	2	2			2
AUT435	Automotive Communication Systems	ECE202	2	2			2
AUT436	Fuel Cell Technology	AUT331	2	2			2
Total							

Content of Core Requirement Compulsory Courses (60 Cr. hr.)

Course Code: MDE001 **Production Technology**
Contact Hours: 1 Lec. – 0 Tut. – 3 Lab, (2Cr. hr.)
Prerequisites:

Course Contents

Types and properties of materials, metal forming. metal cutting processes rules, forging, wire drawing, extrusion, electric welding, spot, welding, Machine tools and processes and Measurement. Practical training on metal cutting, operations on center lathe, milling m/c, shaper and drilling m/c, gear cutting on milling m/c. hand press and mechanical press of different capacities, shearing (banking, piercing and deep drawing processes). Oxyacetylene; different techniques used in oxyacetylene welding, fluxes, welding and cutting torches, prepare and make some joints, safety during welding operations. Arc welding; the main elements, different coatings, welding methods, prepare and make some joints, safety. Resistance welding: main elements, prepare and make some joints, safety.

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Course Code: ECE101 **Electronic Engineering**
Contact Hours: 2 Lec. - 0 Tut. – 2 Lab, (3 cr hr.)
Prerequisite: BSE004

Course Content

Electronic materials: Conductors, Semiconductor, and Insulators –Semiconducting material characteristics - PN junction diodes characteristics, circuits and typical applications (Rectifiers, Regulators and Clipping…..etc.) – Types of signals for electronic circuits – Transistors: Characteristics, types, Circuits and modes of operation – Typical transistor applications – Analog circuits design and applications – Digital integrated circuits design and applications – Amplifiers, OP-AMP characteristics and applications, Counter, Stabilizers, Logic circuit, A/D and D/A conversion circuits, Signal summing and subtracting. Unregulated power supply, Regulated Power supply.

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Course Code: ECE002 **Digital Systems Design**
Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)
Prerequisite:

Course Content

Number systems and digital waveforms - Basic gates and logic functions with a discussion of the available ICs that represent these gates - Boolean algebra, Boolean expressions and truth tables - Sum of products and product of sum forms. Simplifying expressions - K - maps up to fourth degree – Combinational logic, decoders, encoders, multiplexers, demultiplexers, magnitude logic comparators - Digital arithmetic, adders, subtractions, Simple arithmetic and logic unit - Basics of sequential circuits - Basic latches and flip - flops. Timing parameters, Counters - Shift registers, Basic PLD architectures - Discussion of the available ICs for each system.

Laboratory

1. Satisfy with the truth table for all basic logic gates.
2. Implement decoder and encoder using logic gates, and then using the decoder and encoder chips available.
3. Implementing and driving 7 segment display.
4. Building the half and full adder using logic gates, and using full adder chips.
5. Implement an ALU that can perform addition, subtraction, AND, OR, operations using control lines.
6. Satisfy the transition and truth table for all types of flip flops.
7. Experiments on different types of counters.
8. Experiments on different types of shift registers.

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Course Code: ECE201 **Computer Programming**
Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)
Prerequisite:

Course Content

C Programming: Editing, Compiling, Linking, Debugging, Loading and executing. Basic building block – the function. Declaration and definitions, calling a function, modular programming, header file formation and definition file formation. program constructs. C++ Programming: Object Oriented Programming. Classes, constructors, destructors, member functions, function overloading, class derivation, abstract classes. Introduction to MATLAB.

Laboratory

1. Writing C program to solve a simple engineering problem
2. Writing C program to deal with data types
3. Writing C program using Decision statements
4. Writing C program using Loop & nested Loop statements
5. Writing C program using different dimensions of Arrays
6. Writing C program for function programming
7. Writing C program for pointer, string, and function call
8. Writing C program to understand programming with structur

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Course Code: ECE302 **Microcontrollers**

Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)

Prerequisite: ECE201

Course Content

Introduction to microprocessor and microcontroller, architecture of microcontrollers, architecture of microcontrollers used in automotive, microcontroller programming with C or Basic, serial data Input and output, programming timers, counters and interrupts, programming A/D and D/A conversions, microcontroller mini project to control and display of automotive physical variables such as speed, temperature or pressure for automotive systems and components.

Laboratory

1. Experimental with assembly language for the microcontrollers or high level language for the simulator
2. Experiments on dealing with timers and counters hardware and software programming
3. Mini project to design a control system using microcontrollers to control and display of automotive physical variables using A/D and D/A converters.

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Course Code: MPE100 **Thermodynamics**

Contact Hours: 2 Lec. – -0Tut. – 0 Lab., (2 Cr. hr.)

Prerequisite: BSE003

Course Content

Review of thermodynamics fundamentals; work, energy, first law – Properties of substances: pure substances – ideal and perfect gases – steam and water – applications of the first law of thermodynamics for closed and open systems – Carnot and thermodynamic reversibility; the second law of thermodynamics – Clauses inequality – definition of entropy – T-S diagram – Thermodynamic Power Cycles – gas turbine, steam turbine and reciprocating engines – Availability.

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Course Code: MPE103 **Fluid Mechanics**

Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)

Prerequisite: BSE005

Course Content

Basic concepts: definition of a fluid, fluid as a continuum; stress in a fluid, viscosity; pressure and velocity fields – Hydrostatics: static fluid pressure; hydrostatic force on submerged surfaces – Basic concepts in fluid motion: description and classification of fluid motion; acceleration, streamlines/stream tubes; mass conservation, momentum and energy equations; conservation of mass and momentum equation for inertial control volume. – Applications of the mass and momentum equations – Energy in fluids flow: first law of thermodynamics; Euler's equations in streamline coordinates; Bernoulli's equation. Conservation Equations – Navier-Stokes equations; Energy equation; Exact solutions of N-S equations: Couette flow – Principle of dimensional homogeneity. Buckingham theorem. Dimensionless groups and their physical significance. Flow similarity and model testing. Similitude and classification of fluid flows: Reynolds number, Mach number. Force balance and change in momentum – Internal flows: Couette and Poiseuille flow solutions, development length, turbulent pipe flow.

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Course Code: EPE101 **Electrical Engineering**

Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)

Prerequisite: BSE004

Course Content

Basic definition and units. Circuit elements and Kirchhoff's laws. Simple resistive circuits. Network Theorems for solving D.C. networks. Analysis of sinusoidal steady-state circuits. Inductors and capacitors. Network Theorems for solving A.C. networks. Power in electric circuits. Node analysis, circuit theories, methods of superposition.

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Course Code: MDE101 **Technology and Strength of Materials**

Contact Hours: 2 Lec. – 2 Tut. – 1 Lab., (3 Cr. hr.)

Prerequisite: ----

Course Content

Material Properties. Introduction to engineering materials and their properties. The four classes of engineering material. Mechanical behavior: stress-strain behavior, engineering stress and strain, elastic limit, Young's modulus, Poisson's ratio, elastic-plastic behavior, strength, true stress and strain, compressive behavior, hardness, toughness (fracture behavior, brittle-ductile transition), creep deformation and fatigue strength (S-N approach, fatigue limit, strength and life), non-destructive testing. An introduction to the Cambridge Engineering Selector (CES) package for material properties and basic materials selection. The four classes of engineering material - Metals- ferrous alloys - Ceramics – Polymers – Composites – Material testing: Yielding – Fatigue – Fracture – Creep - Corrosion and Stress Corrosion - corrosion protection methods.

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Course Code: MDE102 **Mechanical Drawing using PC**

Contact Hours: 1 Lec. – 2 Tut. – 3 Lab., (3 Cr. hr.)

Prerequisite: BSE008

Course Content

The basic methods for assembly drawings – Exercises in assembly of small-scale mechanical units – Exercises in assembly of large mechanical units – Generation of working and assembly drawings.

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Course Code: MPE202 **Engineering Measurements**

Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)

Prerequisite: BSE004

Course Content

Operating performance of measurement device – Measurement system element – Fixed and variable errors – Measuring error treatment – Digital measuring technique – Force and Torque measurement – Pressure measurement Dynamic pressure measurements – Electric device for pressure measurements – Flow measurement device: area change device; rotating turbine and rotameter – Velocity measurement: pitot tube – Hot wire – Laser – Angular velocity – temperature measurement: Thermometer; bimetal sensor – Variable resistances – Semiconductors Thermocouples – Radiometer.

Laboratory

1. Error in experimental data and filtering
2. Types of sensors and measuring devices
3. Measurement of Volt and Current of electrical system using mulimeters
4. Measurement of Temperature using thermocouple
5. Pressure Measurement test
6. Measuring of angular velocity
7. Measurement of fluid flow rate

Basic Oscilloscope measurements

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Course Code: AUT301 **Automatic Control**

Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 Cr. hr.)

Prerequisite: BSE101

Course Content

Introduction to control system – Physical system modelling – Linear system representations – Linear systems – Laplace Transforms - Feedback: uses and limitations. P, I and D actions – Closed-loop performance: Stability definitions and the Routh-Hurwitz criterion, Stability, system type and SS error, Root locus sketching, rules, Control design using root locus method, pole and zero compensation – Basic compensator (PID) design and tuning using time domain techniques – Frequency domain analysis: Bode plots, phase and gain margins, Nyquist criterion, and Frequency-domain performance. Control design using frequency response, Lead, Lag, and Lead-Lag compensation.

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Course Code: AUT202 **Mechatronics**

Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 Cr. hr.)

Prerequisite: MPE202

Course Content

Introduction and basic definitions, Mechatronics as interdisciplinary subject, Mechatronic system configuration – Mechatronics approach in smart machinery design: Life cycle of product, Mechatronics concurrent engineering, and Design methodology.

Data processing and signal handling: I/O data transfer, A/D and D/A converters. Sensors and actuators for automotive mechatronic systems. Data acquisition and control cards. Controller hardware.

System monitor and simulation: Using software e.g. LabVIEW and Matlab. Design of mechatronics systems using PLC (hardware and software). Design of mechatronics systems using microcontrollers (hardware and software).

****

Course Code: MPE203 **Heat Transfer**

Contact Hours 1 Lec. – - Tut. – 3Lab., (2 Cr. hr.)

Prerequisite: MPE100

Course Content

Heat transfer mechanisms: conduction, convection, radiation; common engineering occurrences and their importance – thermal conductivity and heat transfer coefficient; Fourier's and Newton's laws; thermal resistance of plane, cylindrical and spherical walls and fluid boundary layers; thermal resistance networks; thermal insulation; overall heat transfer coefficient; cooling by fins; radiators; derivation of fin efficiency – Convection and thermal boundary layers: forced and free convection; heat transfer correlations; Nusselt number. Boiling and condensation – Unsteady conduction: one-dimensional conduction with convective boundaries; conductors with internal energy generation and dissipation; heat treatment and cooling; Fourier and Biot numbers.

Experiments (lab)

1. Experiment to evaluate thermal conductivity of materials
2. Experiment to evaluate single phase heat transfer coefficient (free, forced)
3. Experiment to evaluate pool boiling heat transfer coefficient
4. Experiment to evaluate Flow boiling heat transfer coefficient
5. Experiment Heat exchanger effectiveness

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Course Code: MDE301 **Mechanical Vibrations**

Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 Cr. hr.)

Prerequisite: BSE006

Course Content

Fundamentals of vibration (simple harmonic motion, natural frequencies and resonance) – vibration sources and parameters - free udamped and damped single degree of freedom vibration systems – free undamped and damped muti degree of freedom vibration systems – forced single degree and muti degree of freedom vibration systems - methods for formulation of differential equations by Newton and Lagrangian — torstional vibration systems – Vibration of continuous systems - eign values and eigen vectors for linear and tortional vibration systems – whirling of shafts.

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Course Code: MPE304 Internal Combustion Engines
Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)
Prerequisite: MPE100

Course Content

Fundamentals of air-fuel cycles, actual cycles of ICEs, and different properties of the engines' fuels, different methods used for bio-fuels preparation, the different combustion characteristics in spark and compression ignition engines and the performance characteristics of internal combustion engines. Principles of engine operation, performance evaluation and different losses in internal combustion engines. Advance the student's knowledge of thermal efficiencies.

Experiments (Lab)

1. Performance Evaluation of Spark Ignition Engine
2. Performance Evaluation of Compression Ignition Engine

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Course Code: EPE203 Electrical Machines
Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 cr. hr.)
Prerequisites: EPE101

Course Content

Types of electric machines – direct current machines – multi-phase alternative current system – electric transformers – Induction machine – synchronizing machine –converters- small power engines – electric distribution systems – cables and their properties – electric machine safety – electric transformers safety.

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Course Code: ECE202 Introduction to Power Electronics
Contact Hours: 2 Lec. – 0Tut. – 3 Lab., (3 Cr. hr.)
Prerequisite: ECE101

Course Content

Fundamentals of power electronics - Operating principles of switching converters - Buck, Boost, and SEPIC converter operation in CCM and DCM - Time invariant model of switching converters - Role of conduction losses on the efficiency and conversion ratio - switching characteristics of Diodes and FETs - Switching losses and gate drive circuits- Silicon and WBG semiconductor power devices - Power factor definition and PFC topologies - Isolated and resonant converters operating principles - Switching topologies for battery-charger circuits.

Laboratory

1. Study of Buck DC-DC Converter characteristics
2. Study of Boost DC-DC Converter characteristics
3. Study of Single-Phase Inverter characteristics
4. Study of Three-Phase Inverter characteristics
5. Switching characteristics: Doides: NOSFETS and IGBTS

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Course Code: MDE201 Stress Analysis
Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 Cr. hr.)
Prerequisite: MDE101

Course Content

Equilibrium of simple mechanical elements – normal and shear forces – bending and torsion moments – stresses in loaded elastic bars – axial, bending, torsion –strains - rigidity - strain energy – stresses in combined loading – eccentric loads, inclined, bending and torsion – two-dimensional stresses – principle stresses –Mohr circle – theory of failure – applications: thin and thick cylinders – Introduction to the Finite Element Method (FEM) , introduction automotive frames stress analysis using finnite elements.

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Course Code: AUT203 Vehicle Technology
Contact Hours: 3 Cr. hr. = [2 Lect. + 0 Tut. + 3 Lab]
Prerequisite: AUT101

Course Contents

Engines classification –The working cycles of the engines (two-stroke and four-stroke) – Engine construction (stationary parts and moving parts) – Engine lubricating systems (types, layouts, components, operation, and engine oil specifications) – Fuel systems (types, layouts, components and operation) – Engine cooling systems (types, layouts, components, and operation) – Engine ignition systems (types, layouts, components, and operation) Friction clutches (construction and operation principles) - hydraulic clutches and torque converters (construction

and operation principles) - Manual gearboxes (construction, operation) – Cardan shafts - Drive Axles and Differentials - CV Joints (construction and operation) - Automatic gearboxes (construction, operation principles) – Continuously Variable Transmissions (CVT) (construction, operation) - Tires and Wheels - Suspension Systems (types and construction) - Steering Systems (types, operation, Alignment Geometry) - Brake Systems (types, components, operation).

Experiments (Lab)

1. Identify and measure the dimensions of different types of clutches and torque converters components with free hand drawing
2. Disassemble and assemble of manual gearbox and differential and sketch them
3. Identify the CV joints components and sketch them
4. Identify the automatic gearbox components and sketch them
5. Identify the CVT components and sketch them
6. Identify the tires, wheels and suspension systems components and sketch them
7. Identify the steering and brake systems components and sketch them
8. Disassemble and assemble an internal combustion engine (petrol and Diesel), and identify its parts by name and shape
9. Measure the dimensions of the engine moving parts and sketch them
10. Identify the lubrication system components and sketch them
11. Identify the cooling system components and sketch them
12. Identify the petrol and Diesel fuel systems components and sketch them
13. Identify an electronic ignition system component and sketch them

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Course Code: AUT407 **Embedded Systems**

Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)

Prerequisite: ECE302

Course Content

Introduction to embded systems – introduction to HDL – entities and architecture – RTL – dataflow behavioral – FPGA Structure – architecture – configurable logic blocks – routing lookup tables – memory and I/O blocks – FPGA design flow – sequential processes and finite state machines – soft processors – busses and peripherals – embded design tools structure and programming**.**

Laboratory

1. Hands on Laboratory 1: LED Chasing and LED Cube
2. Hands on Laboratory 2: LCD Module Message Display
3. Hands on Laboratory 3: Microcontroller Based Digital Thermometer
4. Hands on Laboratory 4: Multiplexed 7-Segment Display Countdown Timer Interfacing
5. Hands on Laboratory 5: Analog-Digital Converter using LED and LCD Module Interfacing
6. Hands on Laboratory 6: case study: selected automotive embedded system design

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Content of Computer Application Elective Courses (9 Cr. hr.)

Course Code: AUT221 **Computerized Maintenance Management**
Contact Hours:2 Lec. 2 Tut. – 0 Lab. (3 Cr. hr.)
Prerequisite:

Course Content

In this course the software primavera is used to: planning of maintenance operations – planning of manpower requirements – planning of spare parts requrements – preparation of maintenance budgets – plans of annual and monthly maintenance – planning plant shutdown – control of maintenance operations – performance evaluation of maintenance systems – maintenance management by computers – risk analysis in maintenance – artificial intelligence in maintenance - case studies for automotive fleet maintenance management.

Course Code: AUT222 **Automotive Body Design and Analysis**

Contact Hours: 3 Cr. hr. = [2 Lec. + 2 Tut. + 0 Lab.]
Prerequisite: MDE201

Course Content

Automotive body (types and constructions, types of materials, aerodynamics forces and moments, dynamic forces and moments) – Vehicle body shell design (Analysis and Selection of body member sections, body sub frame and underfloor structure, car front and rear end structure, vehicle structure stress analysis by CAD) - Vehicle accident reconstruction and failure analysis - vehicle axles design – Automotive suspension systems design (leaf springs, coil springs, air springs, anti-roll bar torsion springs) – vehicles frames design (cars, mini bus, bus, trucks, tractors semi-trailers) – fifth wheel design.

Computer Lab

1. Course mini project (1): CAD design and drawing for automotive body structure.
2. Course mini project (2): CAD design and drawing for vehicle frames and axles.

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Course Code: AUT223 **Vehicle Aerodynamics**

Contact Hours: 3 Cr. hr. = 2 Lec. + 2 Tut. + 0 Lab.
Prerequisite: MPE103

Course Content

Introduction to vehicle aerodynamics – Fundamentals of fluid mechanics related to vehicle aerodynamics – Aerodynamics forces and moments affecting vehicle body –Aerodynamics drag analysis and reduction – aerodynamics lift analysis and reduction – aerodynamics side force analysis – effect of aerodynamics forces on the vehicle stability and fuel economy - effect of vehicle aerodynamics on ride comfort – Aerodynamics of Commercial vehicles - engine cooling – testing and evaluation of vehicle aerodynamics.

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Course Code: AUT224 **Operatons Research**

Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 Cr. hr.)
Prerequisite: ------

Course Content

Intoduction to operation research – introduction to mathematics and statistics – linear programming (LP) – Optimization using linear programing – graphical linear programing – algebraic solution using simplex and dual-simplex methods – examples of dynamic programing models and computation – optimal solution methods – sensitivity analysis for the objective function changes – project acheduling by PERT-CPM methods - practical case studies.

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Course Code: AUT225 **Hydraulic and Pneumatic Control Systems**

Contact Hours: 2 Lec. – 2 Tut. – 1 Lab., (3 Cr. hr.)
Prerequisite: MPE103

Course Content

Introduction to fluid power - Hydraulic principles – types of hydraulic fluids - Fluid control valves - Hydraulic pumps - Hydraulic motors - Hydraulic circuits and applications in automotive and heavy machinery – application of hydraulic systems in automotive such as hydraulic coupling and torque converters - Pneumatic circuits and applications – Basic electrical control for fluid power circuits – Fluid logic control systems.

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Course Code: AUT421 **Signal Aalysis**

Contact Hours: 2 Lec. – 0 Tut. – 3Lab., (3 Cr. hr.)
Prerequisite: AUT202

Course Content

Signal classification (continuous signals – discrete signals - deterministic and random signals) – continuous time signals analysis - Fourier series representation of peridic signals – FFT – sampling of continuous time signals - aliasing error – analogue and digital filters - probability density functions – case studies from automotive mechatronic systems.

Laboratory

1. Basic signals and time transformation
2. Linear time invariant systems and convolution
3. Fourier transform and it properties
4. Sampling and aliasing error

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Course Code: AUT423 **Spare Parts Inventory Management**

Contact Hours: 3 Cr. hr. = 2 Lec. + 2 Tut. + 0 Lab.
Prerequisite: AUT203

Course Content

Introduction – Inventory definitions - Inventory types – analysis of inventory costs – Basic Economic order quantity (EOQ) – EOQ with quantity discounts – EOQ with storage limitation – Dynamic EOQ models (no setup – with setup) – ABC analysis.

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Specialized Requirement Compulsory Courses (33 Cr. hr.)

Course Code: AUT101 Automotive Engineering Laboratories

Contact Hours: 0 Lec. – 0 Tut. – 3 Lab., (1 Cr. hr.)
Prerequisite: 35 Cr. hr.

Course Content

Practical training related to automotive technology and performance using training aids and laboratory tests. As example engine performance test, traction test, braking test, wheel alignment test, suspension tighting test, wheel balance test. The students will attend this traing in automotive engineering laboratory to learn how to use the different test machines and testers. Each student will make a complete report and will be assessed by a committee nominated from the program organizer.

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Course Code: AUT302 Automotive Electrical Circuits and Systems

Contact Hours: 3 Cr. h = [2 Lect. + 0 Tut. + 3 Lab.]
Prerequisite: AUT203

Course Content

Introduction to automotive electrical circuits (wiring color codes, terminals, switching, circuit diagrams and symbols). Battery Technologies: Lead-Acid Batteries (types, construction, rating capacity, efficiency, charging and discharging characteristics), Nickel-Based Batteries, Lithium-Based Batteries. Voltage regulators (types, construction, characteristics). Alternators (types, construction, performance characteristics). Starting systems (types, construction, performance characteristics). Ignition systems (types, advanced systems, construction, performance characteristics). Lighting systems (circuit diagrams, head light and side light, LED lighting system, headlight dazzling intelligent light). Safety systems (Horn, wiper system, air bag, anti-theft). Multiplexing (multiplex data bus, Controller Area Network CAN, Local Interconnected Network LIN).

Experiments (Lab):

1. Battery Voltage Tests (Open-Circuit and Heavy-Load)
2. Charging System Voltage tests (in –out) vehicle
3. Voltage Regulator Tests
4. Generator Bench Tests
5. Starting system tests
6. Ignition system tests

Course Code: AUT303 Electric and Hybrid Vehicle Technology

Contact Hours: 2 Cr. hr. = [1 Lec. + 0 Tut. + 3 Lab.]
Prerequisite: AUT203

Course Content

Introduction to environmental Impact of electric and electric hybrid vehicles. – architectures of hybrid electric drive trains - electric propulsion systems (construction and operation of DC motors, construction of induction motor drives, consruction and operation permanent magnetic motors -construction and operation of brush-less DC motors drives, switch reluctance motor drive), series hybrid electric drive train design, parallel Hybrid electric drive train design, Mild hybrid electric drive train design,

Experiments (Lab):

1. Indentify the electric and electric hybrid vehicle conponents
2. Disassembling and assembling of induction motors
3. Disassembling and assembling of permanent magnetic motors
4. Disassembling and assembling of electric motors switches
5. Volt and current testing for electric vehicle components and subsytems

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Course Code: AUT304 **Automotive Chassis Design**

Contact Hours: 3 Cr. hr. = [2 Lect. + 2 Tut + 0 Lab]

Prerequisite: MDE201

Course Content

Vehicle axis system and force analysis -Automotive power driveline types (mechanical, hydrodynamics, hydrostatic, electric, hybrid) and design layouts (4x2, 4x4, 6x4, 6x6) - design of friction clutches and their auxiliary mechanisms – Design of hydraulic clutches and torque converters - Design of manual gear boxes (gears, shafts, bearing, seals) - Design of continuously variable transmission (CVT) - Design of propeller shafts, universal joints and final drive differentials – design of traction axles and joints - Design of Drum brake, disc brake, auxiliary units, hydraulic and air brake operating systems - Design of mechanical steering systems - Design of power steering units (hydraulic and electric, Rolling and sliding bearings – Oil seals.

Experiments (Computer Lab)

Course mini project (1): CAD design and drawing for automotive clutches.
Course mini project (2): CAD design and drawing for automotive gear boxes.
Course mini project (3): CAD design and drawing for vehicles traction axles and joints.

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ırse Code: AUT305 **Automotive Fault Diagnosis**

Contact Hours: 3 Cr. hr. = [2 Lect. + 0 Tut. + 3 Lab.]

Prerequisite: AUT203

Course Content

Introduction to automotive fault diagnosis - diagnostic techniques - diagnostic tools and equipment - reading the wiring diagrams - control unit faults detection, vehicle sensors and actuators - Engine performance evaluation - Engine systems fault diagnosis(fuel and fuel injection, ignition, starting, charging, lubrication, cooling) - Chassis systems fault diagnosis(manual and automatic transmission, traction, brake, steering and tires, suspension) – Electrical systems fault diagnosis (multiplexing, lighting, cruise control, HVAC, air bag and belt tensioners, body electrical system, in car entertainment, security and communication) - On-board diagnostics (introduction, history of OBD, OBD2, OBD3, codes).

Experiments (Lab):

Identify and operation of the automotive diagnostic tools and equipment
Engine performance test using engine dynamometers
Engine systems tests using scanners/fault code readers
Engine systems tests using engine analyzer
Engine emission tests
Engine pressure tests
Chassis systems tests (brake and anti-lock brake, traction, transmissions)
Electrical systems tests
HVAC and air bag tests

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Course Code: AUT306 **Performance of Electric and Hybrid Vehicles**

Contact Hours: 3 Cr. hr. = [2 Lec. + 2 Tut. + 0 Lab.]

Prerequisite: AUT303

Course Content

Performance of conventional vehicles: (internal combustion engine performance – transmission characteristics - Traction characteristics of vehicles – road resistance – air resistance – vehicle equation of motion – traction dynamics – fuel consumption)

performance of electric and hybrid vehicles: (architectures of hybrid electric drive train - traction motor characteristics – tractive effort and transmission requirement – vehicle performance – tractive effort in normal driving - tractive energy consumption – braking regenerative mode – sizing of the major components – performance of electric propulsion systems - performance of power electroic systems – design of drive train parameters for hybrid vehicle such as engine power capacity, electric motor power capacity) - case study using MATLAB) .

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Course Code: AUT401 **Field Training**

Contact Hours: 2 Cr. hr. =[0 Lect. + 0 Tut. + 6 Lab.]

Prerequisites: (100 Cr. hr.)

Course Content

Students should spend at least 8 weeks in the field training at governmental or private firms or auto service centers after completing at least four semesters. Pre-requirements for this training is the completion of the automotive technology courses. At the end of this period, the students must submit a report describing the experience gained in the training and present this report in front of a committee which grades the entire activity.

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Course Coe: AUT402 **Vehicle Dynamics**

Contact Hours: 3 Cr. h = [2 Lect. + 2 Tut. + 0 Lab.]

Prerequisites: MDE301

Course Content

Mechanics of pneumatic tire (cornering properties, ride properties) – vehicle steering Geometry - Static and dynamic stability for skidding and overturning - Steady-State Handling Characteristics of Two-Axle Vehicles, Steady-State Response to Steering Input, Testing of Handling Characteristics, Transient Response Characteristics, Directional Stability – Handling characteristics of multi -axle vehicles (tractor semi-trailer) - Overview of Suspension Systems, Vehicle Ride Characteristics, Human Response to Vibration (ISO 2631), Vehicle Suspension Models, Ride Comfort, Introduction to Random Vibration and random road surfaces characteristics.

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Course Code: AUT403 **Automotive Maintenance**

Contact Hours: 3 hr. = [2 Lec. + 0 Tut. + 3 Lab.]

Prerequisite: AUT305

Course Content

Introduction to automotive tribology (friction, wear, lubrication) - automotive lubrication oils and greases - Principle of vehicle life cycle and replacement analysis - maintenance management strategies - Engine main parts maintenance and repair - fuel systems maintenance and repair - Ignition system maintenance and repair - lubrication system maintenance and repair - cooling system maintenance and repair – drive train maintenance and repair (clutch, gearbox maintenance, differential) – steering system maintenance and repair - brake system maintenance and repair - Electrical system maintenance and repair - planned maintenance and repair.

Experiments (Lab):

1. Check and change the fuel filter and air filter.
2. Check and adjustment the engine valves clearance.
3. Check and change of spark plug, spark plug wires and oxygen sensor.
4. Starting and charging systems components tests.
5. Inspection and testing of petrol and diesel fuel injectors .
6. Diesel engine fuel pump testing and repair.
7. Check and change of engine oil, oil filter and fill the transmission oil.
8. Check and fill the brake, steering and cooling fluids.
9. Change the brake pads, linings, drums and rotors
10. Check and replacing belts, CV joints and suspension units
11. Engine removal, disassembly, inspection, measurements and major repair.
12. Engine assembly and tune-up.
13. Wheel alignment test and tire maintenance (pressure, rotation, wheel balance).

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Course Code: AUT404 **Automotive Mechatronics Systems Design**

Contact Hours: 3 Cr. h = [2 Lect. + 2 Tut. + 0 Lab.]

Prerequisite: AUT301

Course Content

State-space approach, Controllability and Observability, Vehicle cruise PID controller Design using MATLAB , PID Tuning Methods, Vehicle handling controller design using Pole Placement method, Active suspension design using Linear Quadratic Regulator (LQR), Design of State Observers for vehicle sub-systems with CAD, Automotive Engine and driveline control systems design , Anti-lock braking system (ABS) and Steering system control design using CAD

Course Code: AUT405 **Graduation Project-1**

Contact Hours: 2 Lec. – 0 Tut. – 3 Lab., (3 Cr. hr.)
Prerequisite: 128 Cr hr
Course Content
Students work in groups throughout the part of graduation project to design, model and plane the activity of the project. This is based on a proposal approved by a member Department staff. The group is required to develop the proposal as a Product Specification and Quality Plan, in collaboration with the Supervisor acting as client. It must also keep full records of the subsequent design, manufacture and test project in compliance with industrial standards. Prepare a sub-report containing the full details of the design, model, and plane of implementation.

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Course Code: AUT406 **Graduation Project-2**
Contact Hours: 2 Lec. – 1 Tut. – 3 Lab., (٤ Cr. hr.)
Prerequisite: AUT405
Course Content
Students of the same groups approved in AUT405, should be work to implement, test, modify the design, and finally submitted a working product. This course focus on the implementation stage of the project output product. Testing of each item based on the standard used within the design phase. Modification of each item or part that does not fulfil the required specifications. The group is required to develop a final report, following all of the technical report specifications that contains ful details of the design, modeling, implementation, testing, and result analysis.

Specialized Requirement Elective Courses (12 Cr hr)

Course Code: AUT226 **Automotive Powertrain Systems**

Contact Hours: 2 Cr. hr. = 1 Lec. + 0 Tut. + 3 Lab

Prerequisite: AUT203

Course Content

Vehicles powertrain arrangement – Front wheel drives, rear wheel drive and all wheel drives - Powertrain elements - passenger cars transmissions (manual, automated, dual clutch, automatic, continuously CVT) – Commercial trucks transmissions – Bus transmission – Hydrodynamics (hydraulic coupling and hydraulic torque converters) - hydrostatic transmissions - propeller shafts and final drive differentials – Drive axles - Powertrain dynamics and control – Fuel economics – Powertrain modeling and computer simulation.

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Course Code: AUT331 **Automotive Engines Alternative Fuels**

Contact Hours: 2 Cr. hr. = [2 Lec. + 0 Tut. + 1 Lab.]

Prerequisite: MPE304

Course Content

Introduction to alternative fuels –automotive fuels specifications - compressed adsorbed natural gas fuels (CNG and ANG) - liquefied petroleum gas (LPG) and liquid natural gas fuels (LNG) - Biogas and Biodiesel fuels – alcohol fuels (methanol and ethanol) - Hydrogen fuel cell -gasoline fuel additives – diesel fuel additives – storage, distribution, and handling of gasoline and diesel fuels - the economic impact of alternate fuels – test cycles, sampling, and analysis of exhaust emissions.

Experiments (Lab)

Chemical anaylysis for automotive fuels

Engine performance testing (speed, torque, power and SFC)

Basic sampling of the exhaust gases

Emission testing for natural gas and gasoline engines.

Emission testing for diesel engines

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Course Code: AUT332 **Automotive Air Conditioning**

Contact Hours: 3 Cr. hr. = 2 Lec. + 0 Tut. + 3 Lab

Prerequisite: MPE203

Course Content

Introduction to Air conditioning systems design- Air conditioning system components and location in a car - Climate Control system components, Types of AC compressor, Evaporator, Condenser, Control panel and switches, AC filter and dryer, Air ducts and flow, AC cooling fan, Heating and Ventilation System, Relation between Engine Cooling System and AC, type of AC refigerants, cooling, load calculation method – refrigeration and air conditioning loads application - AC routine maintenance.

Experiments (Lab):

Assembling and disassembling AC components onboard a real Lab Vehicle.

AC maintenance policy and test procedure.

Charging and discharging the AC GAS.

To oversee the components differences between Air condition and Climate Control.

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Course Code: AUT333 **Automotive Pollution Control**

Contact Hours: 2 Cr. hr. = 2 Lec. + 0 Tut. + 0 Lab.

Prerequisite: MPE304

Course Content

Introduction to pollution (air pollution, water pollution, land pollution, noise pollution, light pollution) - automotive pollution - Fuel Evaporation Control - Early fuel evaporation (EFE) systems (thermostatic air cleaner) - Emissions control system, Enhanced evaporative emissions control system - Crankcase emission - Road draught crankcase ventilation system - Positive crankcase ventilation (PCV) system - Catalytic converter - Catalyst converter operating conditions - Catalyst monitor - Air injected exhaust systems - The need for air

injection - Effects of air-injection on carbon monoxide and hydrocarbon - Internal and external engine modifications

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Course Code: AUT334 **Automotive Preventive Maintenance**

Contact Hours: 3 Cr. hr. = 2 Lec. + 2 Tut. + 0 Lab.

Prerequisite: AUT303

Course Content

Introduction of Automotive preventive maintenance, Maintenance goals and objectives, time-based preventive maintenance – usage-based preventive maintenance - linear programming, mathematical representation for linear programming, graphical solution of linear programming system, mathematical solution of linear programming, Pre-trip inspections, maintenance training and maintenance management information system, Outline the basics of the service station planning and workshops flow rate. Calculate the number of maintenance requirement an evaluation of the service station, application of linear programs in maintenance filed–vehicle replacements. – Preventive Maintenance Case studies using computer programming

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Course Code: AUT335 **Vehicle Energy Storage Systems**

Contact Hours: 2 Cr. hr. = [2 Lec. + 2 Tut. + 0 Lab.]

Prerequisite: AUT303

Course Content

Electrochemical batteries: (lead acid batteries technology, performance and recharging – nickel based battries performance and recharging – lithium based battries performance and recharging) – ultracapacitors: (features of ultracapcitors – basic principle of ultracapacitors – performance of ultracapacitors – ultracapacitors technology) – ultrahigh speed flywheels: (operation priciples of flywheels – power capacity of flywheel systems – flywheel technology) - hybridization of energy storage

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Course Code: AUT431 **Automotive Power Electronics**

Contact Hours: 2 Lec. – 1 Tut. – 2 Lab., (3 Cr. hr.)

Prerequisite: ECE202

Course Content

Itroduction – automotive motor drives (braushed DC – induction motor drives – DSP control of induction motors – switched reluctance motor drives – brushless DC motor drives) – integrated starter alternator ISA (types – specifications -applications) - modeling and control of electric machines – testing of electric motors and controllers for electric and hybrid vehicles.

Experiments (Lab):

1. Electric motors acceleration test
2. Electric motors cruising speed test
3. Testing of electric motor/controller in vehicle environment

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Course Code: AUT432 **Intelligent Vehicle Technology**

Contact Hours: 2 Lec. – 2 Tut. – 0 Lab., (3 Cr. hr.)

Prerequisite: AUT404

Course Content

Introduction to intelligent vision systems (driver vision –component of a vesion sensor system – non contact sensors) – vehicle information system and intelligent transportation (intelligent transportation system (ITS) – vision for ITS communication – multimedia communication in vehicle – vehicle to vehicle and road to vehicle communication system – inter and intra vehicle communication) – adaptive control techniques for intelligent vehicles (automatic control of highway traffic and moving vehicles – pole placmment control - model reference adaptive control - self tunning adaptive control) – decisitional architectures for autonomous vehicles.

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Course Code: AUT433 **Automotive Accident Analysis**

Contact Hours: 2 Cr. hr. = 2 Lec. + 0 Tut. + 0 Lab.

Prerequisite: AUT402

Course Content

Introduction to automotive accidents analysis – Vehicle kinetics and kinematics - types and causes of accidents – environmental factors – geometrical characteristics of highways factors – Vehicle structure crash mechanics - accidents reconstruction (scene investigation, tools and equipment, tire marks and vehicle damage, speed estimates, vehicle inspection, sketches and mapping, Traffic information and vision systems, numerical modeling and simulation) – occupant kinematics - vehicle passive safety systems – vehicle active safety systems - Course mini projects by analysis of real accidents.

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Course Code: AUT434 **Automotive Safety Systems**

Contact Hours: 2 Lec. – 0 Tut. – ٠ Lab., (2 Cr. hr.)

Prerequisite: AUT402

Course Content

Introduction to vehicle and passenger safety – vehicle safety (engine safety systems – antitheft alarm system – antilock braking system ABS – traction control system - adaptive cruise control systems – reverse sensing and parking systems- bumpers and impact bars for safety) – passenger safety (seatbelt control system – window safety system – airbags - driver assistance systems and stress montring)

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Course Code: AUT435 **Automotive Commenication Systems**

Contact Hours: 2 Lec. – 0 Tut. – ٠ Lab., (2 Cr. hr.)

Prerequisite: ECE202

Course Content

Introduction to vehicle communications: (intera vehicle communication protocols – communication between sensors and systems – vehicle communication co operative driving (accident warning - frontal rear collision preventive lane change assistance) traffic information multimedia support and smart parking) – communication fundamentals and technologies: (frequency – bandwidth – SNR – radar operation – collision avoidance radar – transmission technologies – GSM – CDMA – bluetooth – WLAN – networking formation and area of coverage) - intra vehicle communication: (wired communication network two tier approach LIN and CAN applications – wirless Bluetooth vehicle application – satellite radio – vehicle care – traffic status) - inter vehicle communication: (vehicle traffic monitoring – collision and congestion avoidance – highway lane reservation – emission control – AM and FM radio – GPS – wireless LAN – intelligent roadway infrastructure to vehicle and vehicle to vehicle communications)

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Course Code: AUT436 **Fuel Cell Technology**

Contact Hours: 2 Lec. – 0 Tut. – 0 Lab., (2 Cr. hr.)

Prerequisite: AUT331

Course Content

Knowledge of hydrogen chemistry – The hydrogen economy – Basic chemistry of hydrogen and hydrogen safety – Hydrogen production methods – Hydrogen production from natural gas – Water electrolysis and chlor-alkali electrolysis – Hydrogen storage methods – Hydrogen distribution – Hydrogen uses – Hydrogen fuel cells, ICE. Fuel cell kinetics and catalysis – Fuel cell materials and operational –Fuel cell types and applications – Calculating output voltage – Calculating maximum output voltage – Effect of temperature and operating pressure on output voltage- Geo-political, social, and environmental aspects.

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Student Affairs **General Supervisor**

Dean