3. Bachelor of Science in Mechanical Engineering Program Specialist Course Syllabi

Course Code	ME 118			
Course Title	Thermal Engineering (For Non-ME students)			
Year/Level	**2/4**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	--	1
Prerequisite	PHYS 203			
Course Description	Introduction to thermodynamics: Thermodynamical systems. Temperature and the zeroth law of thermodynamics. First law of thermodynamics: Open and closed systems. Second law of thermodynamics: Thermal engine. Carnot's efficiency. Gas turbine: Brayton's cycle. Steam turbine: Rankine cycle. Steam compression refrigeration systems. Conductive heat transfer: Overall heat transfer coefficient. Convective heat transfer: Free and forced convection mechanism. Radiative heat transfer: Electromagnetic spectrum and radiation physics. Kirchoff's law. Black-body radiation. Grey and real bodies. Radiation functions.			
Textbook	Michael J. Moran, Howard N. Shapiro, Bruce R. Munson, David P. DeWitt , "Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer", John Wiley & Sons, Inc.,2003.			

Course Code	ME 131			
Course Title	Engineering Drawing			
Year/Level	**2/3**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	--	5	--
Prerequisite	---			
Course Description	Introduction and importance of engineering drawing, Manual drawing, drawing instruments and their uses, conventions in drawing, geometrical constructions, scales, curves in engineering practice, principles of projections, projections of points, lines, planes and solids, orthogonal projection, isometric pictorial drawings using drawing tools and free hand, rules of writing dimensions, deduction of missing projection, section drawing, surface developments, relation between point, straight line and plane, intersection of planes, engineering applications.			
Textbook	-W J Luzadder and J M Duff, Fundamentals of Engineering Drawing, 11th edition, Prentice-Hall of India, 1995 . -K Venugpoal, Engineering Drawing and Graphics, 3nd edition, New Age International, 1998. -K.L.Narayana, P.Kannaiah, K.Venkata Reddy "Machine drawing" New age international publishers; 3rd Ed.2006..			

Course Code	ME 132			
Course Title	Engineering Design			
Year/Level	**2/4**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	ME 131			
Course Description	Developing a mathematical model by spreadsheet. Introduction to models. Real world versus model world. The use of heuristics in modelling. Model calibration. Introduction to project management models. Building Optimization model. Creating subjective models. Communication Skills.			
Textbook	Clive L. Dym and Patrick Little "Engineering Design, a Project-Based Introduction", 4th Ed., John Wiley and Sons, Inc., NJ, USA, 2014.			

Course Code	ME 133			
Course Title	Dynamics			
Year/Level	**2/4**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	--	2
Prerequisite	PHYS 103			
Course Description	Kinematics of rectilinear and curvilinear motion of particles. Dynamics of particles and systems of particles. Kinematics of rotation and plane motion of rigid bodies. Work and energy relations. Impulse and momentum principles. Dynamics of rigid bodies in plane motion.			
Textbook	R. C. Hibbeler, "Engineering Mechanics: Statics and Dynamics", 12th Ed., Prentice Hall, 2009.			

Course Code	ME 137			
Course Title	Engineering Mechanics **(For non-ME students)**			
Year/Level	**2/4**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	PHYS 103			
Course Description	Introduction. Force Systems. Statics equilibrium. Distributed forces (centroids and moment area). Beams. Friction. Kinematics of particle. Planar kinematics of a rigid body. Kinetics of particle: force, work and energy. Planner kinetics of rigid body: force, work and energy.			
Textbook	R. C. Hibbeler, "Engineering Mechanics: Statics and Dynamics", 12th Ed., Prentice Hall, 2009.			

Course Code	ME 211			
Course Title	Thermodynamics (1)			
Year/Level	**3/5**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	-	-
Prerequisite	PHYS 203			
Course Description	System and control volume concept. Properties of a pure substance. Work and heat. The first laws of thermodynamics as applied to system and control volume, internal energy, enthalpy. The second law of thermodynamics. Canrnot cycle, entropy, reversible and irreversible process. Applications of steady-state, steady-flow, uniform state, uniform-flow, and other processes.			
Textbook	Rayner Joel , "Basic Engineering Thermodynamics", Longman group ,UK ltd,1987			

Course Code	ME 234			
Course Title	Mechanical Drawing			
Year/Level	**3/5**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	1	3	-
Prerequisite	ME 131			
Course Description	Graphical interpolation of machine components and assemblies through the study of orthographic projection to include auxiliary views; section drawings and full dimensioning; translation of design instruction into detailed and assembly drawing; Evolving details of components from assembly considerations. Detailing of components involving shafts, bearing, pulleys, gears, belts, brackets for assembly. drawing conventions including weldments, piping, referencing and surface finish notation; selection of tolerances based on design requirements.			
Textbook	-Luzadder and Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., 11th Edition, 2004 -P S Gill, A text book of Machine Drawing, 17th Edition, S K Kataria & Sons, 2012			

Course Code	ME 251			
Course Title	Production Engineering & Workshop			
Year/Level	**3/5**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	3	-
Prerequisite	ME 131			
Course Description	Limits, fits, tolerance charts. Part analysis, process selection and operations sequence planning. Integrating and combining operations. Workpiece control, cutting tools, dies, and work holding devices. Mechanized assembly and functional gaging. Metal cutting economics and process selection.			
Textbook	Bruce J Black CEng MIEE, "Workshop Processes, Practices and Materials", 3th			

	Ed., *Amazon Whispernet*, 2004.

Course Code	ME 261			
Course Title	Materials science			
Year/Level	**3/5**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	CHEM 106			
Course Description	Atomic bonding in solids, bonding forces and energies, primary and secondary bonds. The structure of crystalline solids, lattice, unit cell, and crystal systems, density computation, crystal directions and planes, linear and planar atomic densities. Impurities and imperfections in solids: point, line and interfacial defects. Atomic vibration and diffusion. Mechanical properties of materials. Elastic and plastic deformation and recrystallization. Phase diagrams of single phase and multiphase materials with emphasis on iron-iron carbide system (steel and cast iron). Thermal processing of materials and alloys: annealing, normalizing, quenching and tempering, composite materials, polymers. Impact, fracture, fatigue and creep properties and introduction to fracture mechanics.			
Textbook	William D. Callister, David G. Rethwisch, "Materials science and engineering: An introduction", 9th Ed. John Wiley and Sons, Inc., 2013.			

Course Code	ME 268			
Course Title	Materials Engineering (For non-ME students)			
Year/Level	**2/4**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	1
Prerequisite	PHYS 103			
Course Description	Introduction to properties of engineering materials: mechanical, electrical and chemical. Fundamentals of crystallography. Impurities and imperfections in solids. Atomic vibrations and diffusion. Single phase metals and alloys: Elastic and plastic deformation, recrystallization, fracture, fatigue and creep. Multiphase materials; phase diagrams with emphasis on iron – iron carbide system. Heat treatment process such as annealing, normalizing and quenching. Studies of widely used engineering materials; steels, plastics, ceramics, concrete and wood.			
Textbook	William D. Callister, David G. Rethwisch, "Materials science and engineering: An introduction", 9th Ed. John Wiley and Sons, Inc., 2013.			

Course Code	ME 212			
Course Title	Thermodynamics (2)			
Year/Level	3/6			
Hours	Credit	Lec.	Lab.	Tut.
	3	2	2	-
Prerequisite	ME 211			
Course Description	Power cycles, Rankine, reheat, and regenerative cycles. Maxwell relations, ideal and real gases, equations of state, generalized charts. Gas-vapor mixtures, psychometric charts, ideal solutions. Chemical reactions. Fuels and combustion processes.			
Textbook	Rayner Joel , "Basic Engineering Thermodynamics", Longman group ,UK ltd,1987			

Course Code	ME 252			
Course Title	Metal forming			
Year/Level	3/6			
Hours	Credit	Lec.	Lab.	Tut.
	3	2	2	-
Prerequisite	ME 251			
Course Description	Yield criteria for ductile metals- Flow theories – Strain hardening- Recrystallization. Fundamentals of metal forming-Effect of temperature, Speed and metallurgical microstructure on forming processes, mechanics of metal forming, Forging processes- equipment, defects, Types of rolling mills – Process variables – defects, Types of extrusion- Process variables- wire drawing- deep drawing- sheet metal working- high energy rate forming processes.			
Textbook	MikellP. Groover, Fundamental of Modern Manufacturing, Materials, Processes and System, 2007.			

Course Code	ME 262			
Course Title	Mechanical testing of materials			
Year/Level	3/6			
Hours	Credit	Lec.	Lab.	Tut.
	1	-	3	-
Prerequisite	ME 261			
Course Description	Testing and understanding the mechanical properties of engineering materials. Mechanical testing machines and types, materials characteristics, tensile and compression test, shear and torsion tests, hardness test and impact test. Creep and Fatigue test.			
Textbook	Ferdinand P.Beer and E.Russell Jonston, Mechanics of materials, Norman E. Dowling, Mechanical Behaviour of Materials, 2003.			

Course Code	ME 263			
Course Title	Mechanics of materials			
Year/Level	**3/6**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	CE 111			
Course Description	Concept of strain and deformation- Lagrangian and Eulerian descriptions of motion, deformation - gradient tensor. Transformation of length, area and volume elements. Conservation laws and stress measures- transport theorems, balance of mass, momentum and angular momentum Cauchy theorem and problems. Stress and deformation of axially loaded members; thermal stresses; pressure vessels; energy concepts; torsion of circular and thin-walled sections; shear and bending moment diagrams in beams; elastic bending; shear stress in beams; compound stresses; stress transformation; deflection of beams and introduction to the concept of singularity functions.			
Textbook	Ferdinand P. Beer and E. Russell Johnston, Mechanics of materials * Norman E. Dowling, Mechanical Behavior of materials, 2003.			

Course Code	ME 271			
Course Title	Theory of machines			
Year/Level	**3/6**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	ME 133			
Course Description	Kinematic analyzes of mechanisms, position, speed and acceleration of mechanisms, dynamic analysis of mechanisms, cams, balancing, dynamics of reciprocating mechanisms, gears, simple gyroscopic forces, governors, joints, belts, brakes, applications, introduction to mechanical vibration.			
Textbook	Thomas Bevan "Theory of Machines" , C.B.S Publishers, First Edition,			

Course Code	ME 313			
Course Title	Fluid mechanics			
Year/Level	**4/7**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	ME 211			
Course Description	Definition and properties of fluids. Fluid Statics with application. Basic fluid dynamic equations of continuity, energy and momentum with applications to different flow situations and flow measurement. Viscous effects, boundary-layer concepts, laminar and turbulent flow in pipes, open channel flow, fluid dynamics forces on immersed bodies. Modeling and dimensional similarity. Introduction to turbomachinery.			
Textbook	R. M. Bruce, F. Y. Donald, H. O. Theodore, W. H., Fundamentals of Fluid			

	Mechanics, John Wiley & Sons, Inc., 6th Ed., 2010.

Course Code	ME 335			
Course Title	Machine Design (1)			
Year/Level	**4/7**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	1
Prerequisite	ME 234			
Course Description	Design process, review of stress, strain and deformation analysis as applied to mechanical design; properties of material; review of static failure theories; designing against fatigue failures; element design; shaft, keys, couplings, power screws; bolted, riveted and welded joints.			
Textbook	Shigley, J.E. and C.R. Mischkle, "Mechanical Engineering Design" 5th, McGraw Hill, 1989			

Course Code	ME 364			
Course Title	Materials Engineering			
Year/Level	**4/7**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	2	-
Prerequisite	ME 261			
Course Description	Basics of materials science, Defects and imperfections Solidification Theory, Metallurgical forming: Casting, rolling extrusion, drawing, development of grain structure for specific properties. Polymeric materials, Polymer processing: extrusion, injection molding blow molding, rotational molding, vacuum forming and related processes processing of cellular polymers, Composite materials, Processing of composites: lay-up methods, press / autoclave / resin transfer molding, pultrusion and filament winding, Powder metallurgy and ceramic materials: green fabrication methods, sintering, hot pressing, spark plasma sintering, development of microstructure in powder processed materials, Coating methods: PVD methods, CVD methods, electrodeposition and electroforming methods, joining: fusion welding, solid state welding, adhesive bonding and mechanical joining machining: Electro machining (electrochemical and electro-discharge) and mechanical machining. Semiconducting and superconducting materials, engineering applications.			
Textbook	-Introduction to Materials Science for Engineers, Global Edition, James Shackelford, Pearson Education Limited. -Materials Processing Handbook, Michael T. Powers, Enrique J.Lavemia, Joanna R.Groza, and James F.Shackelford , CRC Press 2007. -Materials Processing and Manufacturing Science By Rajiv Asthana, Ashok Kumar, Narendra B, Academic press Elsevier, 2006.			

Course Code	ME 372			
Course Title	System dynamics			
Year/Level	**4/7**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	1
Prerequisite	MATH 319			
Course Description	Dynamics of mechanical, fluid, electrical and thermal systems. Equations of motion. Dynamic response to elementary systems. Modeling of Mixed Discipline Systems, Electromechanical systems, Hydraulic/Pneumatic systems, Electrohydraulic systems, Basic energy converters. Transfer functions models. Solution Methods of Dynamic Models, analytical solution of linear systems, root finding, pole-zero diagrams. Numerical simulation of dynamics of complex systems. Dynamic stability of systems. Laboratory sessions involve use of computers for simulation and analysis of dynamic systems.			
Textbook	William J. Palm III, System Dynamics, 3rd Edition, McGraw-Hill College, 2013.			

Course Code	ME 314			
Course Title	Heat transfer			
Year/Level	**4/8**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	ME 212			
Course Description	An introduction to heat transfer by conduction, convection and radiation. Steady state solution applied to wall, sphere and pipe insulation, heat sources, and extended surfaces (fins). Unsteady heat transfer to plates, cylinders and spheres (Heisler charts). Black and gray body radiation systems and electrics network analogy. Practical hydraulic and thermal analysis of forced and natural convection system with application to heat exchangers.			
Textbook	F.P. incropera, D.P. DeWitt.Introduction to Heat Transfer, sixth edition,			

Course Code	ME 315			
Course Title	Mechanical measurements			
Year/Level	**4/8**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	1	2	-
Prerequisite	ME 271			
Course Description	Fundamentals concepts and analysis of data gained from experiments, electronics instrumentations, measuring pressure, flow, and temperature, thermal properties, Measuring the force, power, torque, stress, lengths and areas measurement, limit gauges design, displacement, velocity, and angle measurement, surface, flatness and roughness measurements, measuring some			

	mechanical elements such as springs and gears.
Textbook	A. K. Bewoor and V. A. Kulkarni, Metrology & Measurement, Tata McGraw-Hill Education, 2009**.**

Course Code	ME 336			
Course Title	Machine design (2)			
Year/Level	**4/8**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	1	-
Prerequisite	ME 335			
Course Description	Design of elements; bearings (journal and anti-friction), springs, spur, helical, bevel and worm gears; flexible drives (belts and chains); clutches and brakes; design optimization. Laboratory sessions to supplement and to apply the material covered in the lectures. Consideration of manufacturing aspects of the design (limits and fits). Study of projects considering the different stages of their design, manufacturing and assembly.			
Textbook	Shigley, J.E. and C.R. Mischkle, "Mechanical Engineering Design" 5th, McGraw Hill, 1989			

Course Code	ME 373			
Course Title	Mechanical vibrations			
Year/Level	**4/8**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	1	-
Prerequisite	ME 271			
Course Description	Free and forced vibrations. Applications to systems with one, two and multi-degree of freedom. Viscous, hysteretic and Coulomb damping. Response to general periodic excitation. Transient vibration and the phase plane method. Principal and coupled coordinates. Dynamic vibration absorbers. Energy methods and Rayleigh's principle. Laboratory sessions are devoted to applications and experiments to illustrate various phenomena studied. Vibration measuring instruments and measuring techniques are emphasized.			
Textbook	Rao,S.S. and Weiley,A., Mechanical vibrations. 4th edition, Prentice Hall, 1995			

Course Code	ME 496			
Course Title	**Summer training**			
Year/Level	**4/8**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	--	--	-
Prerequisite	**ENG 357 and Department approval**			
Course Description	A continuous period of eight weeks of summer training spent in the industry working in any of the fields of mechanical engineering. The training should be			

	carried out in an organization with an interest in one or more of these fields. On completion of the program, the student is required to submit a formal written report of his work.
Textbook	----------

Course Code	ME 453			
Course Title	Theory of metal cutting and machining			
Year/Level	**5/9**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	ME 252			
Course Description	Metal Cutting; mechanics, Tool materials, Temperature, Cutting Forces, Wear and Tool Life considerations, tool geometry and chip formation, surface finish and machinability, optimization of cutting parameters; Machine Tools: generation and machining principles, Setting and operations on machines viz. Lathe, milling, shaping, slotting, planing, drilling, boring, broaching, grinding (cylindrical, surface, centreless), thread rolling and gear cutting machines; Tooling: jigs and fixtures, principles of location and clamping; Batch. Production and Mass Production, Operations on Capstan and Turret Lathes, Single Spindle Automats. Finishing: microfinishing operations like honing, lapping and superfinishing.			
Textbook	Mikell. P. Groover, Principles of Modern Manufacturing, 4th Ed., John Wiley & Sons Inc., 2011.			

Course Code	ME 474			
Course Title	Automatic control			
Year/Level	**5/9**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	ME 372			
Course Description	Classical control techniques, basic control actions. Block Diagrams, block diagram reduction, transfer functions. Analysis of control systems, stability, steady state error. Design of systems by means of root locus method, and Bode plots. Control system synthesis. Classical controllers types proportional, derivative and integral control actions. State variable feedback. Linear quadratic controller. Practical experiments, laboratory sessions involve utilization of control software for analysis and design of control systems.			
Textbook	Farid Golnaraghi, Benjamin C. Kuo "Automatic Control Systems" July 7, 2009			

Course Code	ME 498			
Course Title	Senior Design Project (1)			
Year/Level	**5/9**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	1	--	3	-
Prerequisite	ENG357, ME 313, ME 335 and ME 372			
Course Description	A course that integrates various components of the curriculum in comprehensive engineering experience so that the basic sciences, mathematics, and engineering sciences which the student has learned in his freshman-to-senior years of study can be applied. It considers design of a complete project of system including establishment of objectives and criteria, formulation of the problem statements, preparation of specifications, consideration of alternative solutions, feasibility consideration, and detailed engineering designs. The design should take into consideration appropriate constraints such as economic factors, safety, reliability, ethics and environmental and social impact. Submission of a written report is an essential requirement for completion of the course. Team design projects, where appropriate, are highly encouraged.			
Textbook	To be determined by the supervisor according to the project topics			

Course Code	ME 499			
Course Title	Senior Design Project (2)			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	--	7	-
Prerequisite	ME 498			
Course Description	Continuation and completion of project started in ME 498. Oral presentation and submission of final written report of the design project are essential requirements for the completion of the course.			
Textbook	To be determined by the supervisor according to the project topics			

Course Code	ME 416			
Course Title	Internal Combustion Engine			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	ME 314			
Course	Analysis of spark ignition, compression ignition, and gas turbine engines.			

Description	Combustion processes in an actual system. Performance characteristics. Combustion abnormalities. Analysis of intake, fuel, and exhaust systems. Laboratory experiments will illustrate the topics discussed.
Textbook	Colin R. Ferguson and Allan T. Kirkpatrick, Internal Combustion Engines: Applied Thermal Sciences, 2nd Edition, John Wiley and Sons, NY, 2000.

Course Code	ME 417			
Course Title	Renewable Energy			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	3	-
Prerequisite	ME 314			
Course Description	Introduction to renewable energy. Overview of renewable energy technologies. Solar energy. Biomass and Bioenergy. Wind energy. Geothermal energy. Hydro power energy. Wave and tidal energy. Energy, economics and environmental assessments.			
Textbook	Kaltschmitt M., Streicher W., Wiese A., Renewable Energy, Springer London, Limited, Jun 1, 2007.			

Course Code	ME 421			
Course Title	Gas dynamics			
Year/Level	**5/9**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	-	2
Prerequisite	ME 313			
Course Description	Fundamentals of compressible fluid flow (gas dynamics) in relation to effects of area change (nozzles and diffusers), friction and heat interaction (Fanno and Rayleigh lines and isothermal flows), combustion waves (deflagration, explosion and detonation waves), normal and oblique shock waves and their effects on flow properties (extended diffusers and supersonic airfoils). Applications to flow through pipelines, subsonic, sonic and supersonic flight, turbomachinery and combustion.			
Textbook	M.J. Zucrow& Joe D.Holfman "Gas dynamics" ISBN-13: 978-0471984405, John Wiley and Sons; 1 edition, 1976.			

Course Code	ME 422			
Course Title	Refrigeration & Air conditioning			
Year/Level	**5/9**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	-	2
Prerequisite	ME 314			
Course Description	Fundamentals of thermodynamics and heat transfer, thermodynamics of moist air; Construction of the psychometric chart; Psychometric processes; Psychometric systems; Industrial Processes; Air conditioning systems; Duct design and air distribution methods; Cooling towers; Experiments utilizing air conditioning equipment will be conducted in laboratory and design calculations			

	will be practiced in tutorial classes. Mechanical vapor compression refrigeration cycles; refrigerant compressors; refrigerants; absorption refrigeration systems; thermoelectric cooling; flash cooling; gas cycle refrigeration; ultra-low temperature refrigeration; food refrigeration; transport refrigeration. Laboratory experiments on refrigeration equipment.
Textbook	G. Hendy, A. trot and T. Welch "Refrigeration and Air Conditioning" fifth edition McGraw Hill (1990)

Course Code	ME 423			
Course Title	Turbomachinery			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 421			
Course Description	Thermo-fluid dynamics aspects of fluid flow, kinematic relations and efficiencies of turbomachines. Two dimensional cascades; Turbine and compressor cascade correlations and performance. Axial turbines (two dimensional analysis), axial flow compressors and fans (two dimensional analysis), centrifugal compressors and fans, radial flow turbines, and preliminary design fundamentals of turbomachines and three dimensional considerations.			
Textbook	W. W. Peng, Fundamentals of Turbomachinery, John Wiley & Sons, 2008.			

Course Code	ME 424			
Course Title	Hydraulic Pipe Line Systems			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 422			
Course Description	Basic equations of fluid flow, gas flow and liquid flow in pipe. Head loss formula, pump theory and characteristics, steady flow analysis. Manifold flow, pipe network analysis, design of pipe networks, economic design, transient flow, elastic theory of hydraulic flow, pipe system transients, pumps in pipe systems, Network transients, Transient control devices and procedures.			
Textbook	Larock, B. E., Jeppson, R. W. and Watters, G. Z., Hydraulics of pipeline systems. CRC (1999).			

Course Code	ME 425			
Course Title	Thermal Power Plants			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 421			
Course Description	Forms of energy, oil, gas and coal, Combustion processes, energy cycles. Steam generators and their component design, turbines, load curves. Field trips to power plants and other energy installations during laboratory hours.			
Textbook	El-Wakil M. M., Power Plant Technology, McGraw Hill, 1984.			

Course Code	ME 426			
Course Title	Fluid Power Control			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 422			
Course Description	Study of fluid power systems as used in industrial applications to transmit power by the flow of hydraulic fluids. Fluid power circuit diagrams including components such as valves, pumps, motors, filters, reservoirs and accumulators. Analysis of fluid leakage, hydrostatic transmissions, hydraulic stiffness, and performance of positive displacement pumps and motors. Proportional control valves, servo valves. Nonlinearities in control systems. Components of pneumatic systems; directional flow and pressure control valves in pneumatic systems. Hydraulic system design, pneumatic circuit design.			
Textbook	Esposito, A., Fluid power with applications, 4th ed, Prentice Hall, 1997.			

Course Code	ME 427			
Course Title	Power Stations and Desalination			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 422			
Course Description	Introduction to power stations and desalination; Steam power station cycle; Steam generators; Steam turbines; The condensate - Feed water system; Circulating water systems and cooling towers; gas power stations; Desalination- basics of water desalination, thermal methods to salt removal, Multiple effect systems (MED), Multistage flashing systems (MSF), Vapor compression systems (VCD), Dual purpose power plants (DPP); selection of desalination status. Membrane methods of desalination-Reverse Osmosis. Environmental impacts of desalination processes; Renewable-energy powered desalination; Novel desalination technologies, Assessment of economic feasibility of desalination processes.			
Textbook	El-Wakil M. M., Power Plant Technology, McGraw Hill, 1984.			

	E. D. Howe, Fundamentals of Water Desalination, Marcel Dekker, 1974.

Course Code	ME465			
Course Title	Material Selection in Design & Manufacturing			
Year/Level	**5/9**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	-	2
Prerequisite	ME 364			
Course Description	Properties, Applications and Selection of Engineering Materials; Properties of engineering materials and their applications. Materials selection charts, performance maximizing criteria, material indices based on Ashby's analysis. Fundamentals of Manufacturing Processes; metal processing technologies; polymer processing technologies; joining and surface finishing processes. Process Selection and Economic Consideration; economic production capabilities of typical processes.			
Textbook	M.M. Farag, Materials selection for engineering design, Pr. Hall Europe, 1997			

Course Code	ME 475			
Course Title	Mechatronics			
Year/Level	**5/9**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	-	2
Prerequisite	ME 271			
Course Description	Introduction of Mechatronics. Basic circuit review, ideal operational-amplifiers circuits, analog control circuits, hardware components of P, PI and PID controllers. A/D and D/A data acquisition system. Sensors: encoders, solvers, and others, signal conditioning and processing. Micro-controllers and electrical actuators, case study of programming DC and stepper motors motions and control. Mechanical components and mechanisms, programmable motion control and algorithm development of simple mechanisms.			
Textbook	Robert H. Bishop, 2010, Mechatronics: An Introduction, CRC Press.			

Course Code	ME 444			
Course Title	Tribology			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 465			
Course Description	Introduction-Definition of tribology- Basic concepts- Friction, Wear and Types of wear- Applications, Surface topography, Contact mechanics of deformable bodies, Friction of metals, Wear of metals- Abrasive wear, Adhesive wear, Corrosive wear, Surface fatigue and brittle fracture wear, Erosive wear, Impact wear, Hydrodynamic Lubrication.			

Textbook	E. Rabinowicz, Friction and Wear of Materials, 2nd Ed., John Wiley & Sons, Inc., 1995.

Course Code	ME 476			
Course Title	Robotics			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 475			
Course Description	Introduction to Robot Technology. Definition of robot, areas of application, general structure of industrial robots. Geometrical Modeling of Industrial Robot Arms. Homogeneous Transformation Matrix. Position and Orientation of the robot arm end effector center. Generalized homogeneous transformation matrix of robot. Direct Kinematic Modeling of Industrial Robot Arms: Direct kinematic position model (DKPM), direct kinematic velocity model (DKVM), robot arm Jacobian matrix, direct Kinematic acceleration Model (DKAM). Inverse Kinematic Modeling of Industrial Robot Arms. Dynamic Modeling of Industrial Robot Arms. Practical Examples, extensive use of computer simulation programs.			
Textbook	Craig, J.,2005, "Introduction to Robotics: Mechanics and Control", 3rd edition, by Addison-Wesley Publishing Company, Inc.			

Course Code	ME 446			
Course Title	Introduction to Nanotechnology			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 465			
Course Description	Introduction to the course. Materials overview. Overview of Nano Fabrication Methods. Characterization Tools. Zero dimensional Nano structures (Nano Particles). One dimensional Nanostructures. Two dimensional nanostructures. Top down fabrication procedures. Nanomaterial characterization methods. Application of nanomaterials.			
Textbook	Daniel L. Schodek, Paulo Ferreira, Michael F. Ashby “Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers and Architects”, (Butterworth-Heinemann),			

Course Code	ME 477			
Course Title	Automation Technology			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 475			
Course Description	Development of Automation Technology (Automation system components, Discrete manufacturing automation, Continuous process automation, Strategy for automation) – Automated assembly, automated material handling and storage systems – Computerized instrumentation – Computer vision, on-line computer control – Equipment for flexible automation – Robot process applications – Control systems and communications – Sensors, actuators, interfaces & controllers – Design of pneumatic, hydraulic, and electrical systems for automation, use of programmable logic controller for combinational and sequential systems implementation. Tele-mechanics (method of coding, processing of signal, safety circuits).			
Textbook	Frank Lamb,"Industrial Automation: Hands On", McGraw Hill Prof. 2013			

Course Code	ME 454			
Course Title	Design of Cutting Tools & Forming Equipment			
Year/Level	**5/9**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	-	2
Prerequisite	ME 336			
Course Description	Tooling Systems-Definitions, materials types and selections, and systems of specifying. Design of single point cutting tools- Selection of tool materials, tool geometry, cutting parameters for turning shaping operations, design of form tool for machining operations. Design of multiple point cutting tools-Selection of tool materials, tool geometry, cutting parameters for reamer, drilling, milling and broaches machining processes. Design of sheet metal forming equipment's- Design different components of die for sheet metal work, selection of material, determining geometry and dimensions, required forces, configurations and assembly. Design of bulk forming equipment's- Design different components of die for bulk forming work, selection of material, determining geometry and dimensions, required forces, configurations and assembly. Calculation of press capacity required to do this job.			
Textbook	J.R.Crowley, "Die Design Fundamentals", Industrial Press Inc, 1987			

Course Code	ME 455			
Course Title	CAD / CAM			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 454			
Course Description	Introduction to CAD, Numerical techniques for CAD, Numerical control machines, Industrial robotics, Introduction to materials handling, Group technology, Computer aided process planning. CAM fundamentals. Numerical control (NC) manufacturing systems. Part programming, NC justification, advances in NC (CNC, DNC, and adaptive control). Tooling for NC and CNC. Flexible manufacturing systems (FMS) and robotics in manufacturing, Related laboratory experiments.			
Textbook	.P. Groover, E.w.Zimmers, "Computer- Aide Design & Manufacturing", Prentice-Hall, Inc, New Jersey, 1984.			

Course Code	ME 466			
Course Title	Corrosion Engineering			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 465			
Course Description	Technical and economical aspects of corrosion problems. Types of corrosion; pitting, crevice, intergranular, galvanic and stress corrosion cracking. Mechanisms and prevention of corrosion failures. Cathodic protection of pipelines and submerged structures. Principles of inhibition of corrosion in process industries. Behavior of metal and alloys in corrosive environments (high pressure, high temperature, sea water, steam) and its migration. Erosion and cavitation. Metallurgical aspects of corrosion. Design considerations in prevention of corrosion failures. Surface preparation, application and designing of coating systems.			
Textbook	Denny A.Jones, , " principle and prevention of corrosion". Second edition, Prentice Hall. 1996			

Course Code	ME 456			
Course Title	Computer Aided Fixtures Design			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 454			
Course Description	Types and functions of jigs and fixtures. Supporting and locating principles. Clamping and work-holding principles. Design Economics. Template Jigs. Vice-held and plate fixtures. Plate and angle plate jigs and fixtures. Channel and box jigs. Vice-jaw jigs and fixtures. Tooling for numerically controlled machines. Tool materials.			
Textbook	William E. Boyes , Handbook of Jig and Fixture Design, 2nd Edition, SME 1989.			

Course Code	ME 467			
Course Title	Advancing Welding Technology			
Year/Level	**5/10**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	2	2	-	1
Prerequisite	ME 465			
Course Description	Introduction to the course, Brief review of conventional welding process. Advanced welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding, explosive welding/ cladding, Underwater welding, Spray-welding / Metallising, Hard facing, etc. Weld Design. Thermal and Metallurgical consideration.			
Textbook	Sindo Kou; "Welding Metallurgy". John Wiley & Sons, Inc., Publ., 2nd edition, 2003.			

BASIC SCIENCE COURSES

Course Code	MATH 118			
Course Title	Mathematics			
Year/Level	**1/1**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	0	0
Prerequisites	----			
Course Description	Concepts and manipulations in algebra. Trigonometry. Elementary analytic geometry and Linear Algebra. Introduction to concepts of calculus. Preparation for rigorous study of mathematics.			
Textbook	J. Stewart, Calculus, Early Transcendentals, Seventh Edition. International Metric Version, 2012.			

Course Code	MATH 227			
Course Title	Calculus (1)			
Year/Level	**1/2**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	0	0
Prerequisites	MATH 118			
Course Description	Limits and continuity of functions of a single variable. Differentiability. Techniques of differentiation. Implicit differentiation. Local extrema, first and second derivative tests for local extrema. Concavity and inflection points. Curve sketching. Applied extrema problems. The Mean Value Theorem and applications.			
Textbook	J. Stewart, Calculus, Early Transcendentals, Seventh Edition. International Metric Version, 2012.			

Course Code	MATH 228			
Course Title	Calculus (2)			
Year/Level	**2/3**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	0	0
Prerequisites	MATH 227			
Course Description	Definite and indefinite integrals of functions of a single variable. Fundamental Theorem of Calculus. Techniques of integration. Hyperbolic functions. Applications of the definite integral to area, volume, arc length and surface of revolution. Improper integrals. Sequences and series: convergence tests, integral, comparison, ratio and root tests. Alternating series. Absolute and conditional convergence. Power series. Taylor and Maclaurin series.			
Textbook	J. Stewart, Calculus, Early Transcendentals, Seventh Edition. International MetricVersion, 2012.			

Course Code	MATH 319			
Course Title	Calculus (3)			
Year/Level	**2/4**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	0	0
Prerequisites	MATH 228			
Course Description	Polar coordinates, polar curves, area in polar coordinates. Vectors, lines, planes and surfaces. Cylindrical and spherical coordinates. Functions of two and three variables, limits and continuity. Partial derivatives, directional derivatives. Extrema of functions of two variables. Double integrals, double integrals in polar coordinates. Triple integrals, triple integrals in cylindrical and spherical coordinates.			
Textbook	J. Stewart, Calculus, Early Transcendentals, Seventh Edition. International MetricVersion, 2012.			

Course Code	MATH 336			
Course Title	Differential Equations			
Year/Level	**3/5**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	0	0
Prerequisites	MATH 319			
Course Description	First order and first degree equations. The homogeneous differential equations with constant coefficients. The methods of undetermined coefficients, reduction of order, and variation of parameters. The Cauchy-Euler equation. Series solutions. Systems of linear differential equations. Applications.			
Textbook	C. H. Edwards & D. E. Penney, Elementary Differential Equations with Boundary Value Problems, Sixth Edition. Pearson Prentice Hill, 2008.			

Course Code	STAT 354			
Course Title	Statistics and Probability			
Year/Level	**3/6**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	0	0
Prerequisites	MATH 227			
Course Description	Sample space, events, random variables, conditional probability, some discrete and continuous distributions, functions of random variables, sampling distributions, estimation and test of hypotheses.			
Textbook	Ronald E. Walpole, Raymond H. Myers, and Sharon L. *(Author, Title, Pub., year)* Myers, Keying Ye, Probability & Statistics for Engineers and Scientists (Ninth edition), Pearson, 2012			

Course Code	MATH 410			
Course Title	Numerical Methods			
Year/Level	**4/8**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	3	0	0
Prerequisites	MATH 228 + CSC111			
Course Description	Roots of nonlinear equations. Solution of systems of linear and nonlinear algebraic equations. Numerical differentiation and integration. Interpolation, extrapolation, and approximation. Least-squares approximation and regression analysis. Numerical solution of ordinary differential equations. Introduction to error analysis. Engineering case studies.			
Textbook	S.C. Chapra and R.P. Canale, Numerical Methods for Engineers, 6th Hill, 2009			

Course Code	PHYS 103			
Course Title	General physics I			
Year/Level	**1/2**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	4	3	2	-
Corequisite	MATH 227			
Course Description	First course of calculus based, general physics sequence. Topics covered include: Units, changing units, 1D motion, vectors and scalars, 2D and 3D motion, Newton's laws, friction, kinetic energy and work. particle kinematics and dynamics; conservation of energy and linear momentum; rotational kinematics; rigid body dynamics; conservation of angular momentum; simple harmonic motion; gravitation; the static and dynamics of fluids.			
Textbook	Raymond A. Serway and John W. Jewett, Jr. , Physics for Scientists and Engineers with Modern Physics, Ninth Edition, 2014			

Course Code	PHYS 203			
Course Title	Physics (2)			
Year/Level	**2/3**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	1
Prerequisite	PHYS 103			
Course Description	A continuation of PHYS 103. Topics covered include: wave motion and sound; temperature, first and second laws of thermodynamics; kinetic theory of gases; coulomb's law; the electric field; Gauss law; electric potential; capacitors and dielectrics; D.C circuits; the magnetic field; ampere's and Faraday's laws.			
Textbook	Raymond A. Serway and John W. Jewett, Jr. , Physics for Scientists and Engineers with Modern Physics, Ninth Edition, 2014			

Course Code	CHEM 106			
Course Title	General chemistry			
Year/Level	**2/3**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	4	3	2	-
Prerequisite	--			
Course Description	Matter, atomic structure and periodic table, chemical bonding, stoichiometry of pure substances, reaction in aqueous solutions, states of matter (gases, liquids, and solids), mixtures (with emphasis on some physical aspects of solutions), thermochemistry.			
Textbook	Chemistry 9th Edition by Steven S. Zumdahl (Author), Susan A. Zumdahl (Author), Gocengage publishers.			

Course Code	CHEM 206			
Course Title	Chemistry (2)			
Year/Level	**2/4**			
Hours	**Credit**	**Lec.**	**Lab.**	**Tut.**
	3	2	2	-
Prerequisite	CHEM 106			
Course Description	Chemical equilibria (gases, acids and bases, and solubility quilibria), chemical kinetics, spontaneity of reactions, coordination chemistry, nuclear chemistry, electro chemistry,chemistry of selected representative elements, organic structure and reactions, chemistry of materials.			
Textbook	Chemistry 9th Edition by Steven S. Zumdahl (Author), Susan A. Zumdahl (Author), Gocengage publishers.			

NOTICE

Basic science courses and others courses from different colleges and department Syllabi and Description will be taken from the colleges.

References

1. The national Commission for Academic Accreditation and Assessment (NCAAA), www.ncaaa.org.sa/
2. Accreditation Board for Engineering and Technology (ABET), Inc., www.abet.org/
3. The Bachelor of Science in Mechanical Engineering (1426/2006), Mechanical Engineering Department, College of Engineering, Jazan University, KSA, www.jazanu.edu.sa/
4. The Bachelor of Science in Mechanical Engineering, King Fahd University of Petroleum & Minerals, KSA, www.kfupm.edu.sa/
5. The Bachelor of Science in Engineering Production and Mechanical Systems Design, College of Engineering, King Abdel Aziz University, KSA, www.kau.edu.sa/
6. The Bachelor of Science in Thermal Engineering and Desalination, College of Engineering, King Abdel Aziz University, KSA, www.kau.edu.sa/
7. The Bachelor of Science in Mechanical Engineering, College of Engineering, King Saud University, KSA, www.ksu.edu.sa/
8. The Bachelor of Science in Mechanical Engineering, College of Engineering, Qassim University, KSA, www.qu.edu.sa/
9. The Bachelor of Science in Mechanical Design Engineering, Credit Hours System, College of Engineering, Cairo University, www.eng.cu.edu.eg
10. The Bachelor of Science in Mechanical Engineering, College of Engineering and Computer Science, University of Michigan, USA, www.engin.umd.umich.edu/ME/
11. The Bachelor of Science in Mechanical Engineering, College of Science, Engineering, and Technology, Minnesota State University, USA, www.mnsu.edu/programs/
12. The Bachelor of Science in Mechanical and Aerospace Engineering, School of Engineering, University of Dayton, USA, www.udayton.edu/