Course-Contents

ME101 Engineering Drawing I
3 Lecture hours per week (3+3) 6 units
Contents:
• The need for a graphic language. • Use and care of drawing instruments and equipment. • Freehand sketching. • Orthographic projections sectioning and dimensioning of single machine elements. • Isometric drawing and dimensioning. • Space analysis of points and lines with applications.

ME102 Engineering Drawing II	
3 Lecture hours per week (3+3) 6 units	Prerequisite: ME101
Contents:	
• Thread dimensioning, standard M/C elements assembly, linking, space analysis, views of a point, lines, true length of line and oblique lines, bearing slope and grade. • Steel structure drawing.	

ME203 Material Science	
3 Lecture hours per week (3+4) 7 units	Prerequisite: ES 122 Corequisite: ME 205
Contents:	
• Introduction to mechanical behavior. • Chemical bonding, inter-atomic relations and coordination. • Atomic order in solids, crystalline structures and crystal geometry. • Atomic disorder in solids, vibrations, atomic rearrangements. • Single phase metals, elastic and plastic deformation of metal crystals, strain hardnening and recrystallization. • Multiphase materials, phase diagrams, fundamental phase reactions, phase diagrams of some industrial alloys.	

ME204 Engineering Materials	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME203
Contents:	
• Industrial phase diagram, iron-carbon system, plain Fe-C alloyes, alloy steels. • Nonferrous alloys, copper and copper alloys, aluminum and aluminum alloys, bearing alloys. • Thermal processing of multiphase materials, heat treatment hardening of steels, corrosion of metals. • Mechanical failure, fatigue, creep. • Plastics.	

ME205 Materials Science Lab.	
3 Lecture hours per week (3+2) 5 units	Prerequisite(s): ES122, Corequisite(s): ME203
Contents:	
• Macroscopic examination of metals, flow lines, welded sections, sulphur printing. • Microscopic examination of ferrous and nonferrous alloys, polishing, etching and microanalysis, electro-chemical nature of corrosion. Tensile tests of structural steels and cast iron, compression test of ductile and brittle materials. • Bending test of wooden beams, load-deflection curves, modulus of rupture.	

ME211 Thermodynamics I	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES111
Contents:	
• Units and some definitions. • Thermodynamic properties, temperature, work, heat, energy. • State of pure substances. • State equation of ideal gases. • First law of thermodynamics. • Energy equation. • Specific heats.	

- Internal energy.
- Enthalpy.
- Control volume and systems.
- Steady state, uniform state processes.
- Second law of thermodynamics.
- Reversibility.
- Entropy.
- Inequality of clausius.
- Entropy changes.

ME212 Thermodynamics II	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES211
Contents:	

- Mixtures: General considerations, Dalton's, Amagat model of a mixture of gas and a vapor, psychrometric chart.
- Combustion: Fuels, combustion process, enthalpy of formation, adiabatic flame temperature, heat of reaction, Bomb and Junker's calorimeters.
- Thermodynamic cycles: Carnot, Rankine, Reheat, Otto, Diesel, Dual, Brayton, Vapour compression refrigeration, ammonia-absorption refrigeration cycles.
- Thermodynamic relations: Maxwell relations, relations involving; enthalpy, internal energy and entropy, thermodynamic tables.

ME222 Strength of Materials I	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES215, ES201
Contents:	

- Linear and non-linear elasticity; plasticity; stress and strain; the elastic constants.
- Fatigue loads; statically indeterminate force system; stresses due to bending, shear and direct force for symmetrical sections.
- Torison of circular section, shear force, bending moment and axial force, combined bending and torsion; columns; composite beams; deflection of beams; equation of elastic curve; thin walled vessels.

ME301 Elements of Machinery I	
4 Lecture hours per week (4+5) 9 units	Prerequisite: ME102, ME204, ME222

Contents:

- Process of designing.
- Recording the design ideas, forms of the design documentation, design analysis, optimum design.
- Calculation models, Mathematical, Physical of the real elements.
- Stresses and external loads.
- Stress concentration, fatigue analysis, optimization of elements loading.
- Joints: Weld joints, riveted joints, screw joints, bolted joints with initial tension, design of power screws.
- Tolerances and fits in connections.
- Standards and international fitting systems.
- Shaft-hub connections: Press fit.
- Axis and Shafts: A rational approach to shaft design.

ME303 Mechanisms	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES216, ME102

Contents:

- Fundamental concepts, properties of motion, relative motion, linkages, instant centers, velocities by instant centers and by components.
- Method of relative velocities, accelerations in mechanisms, cams, miscellaneous mechanisms.
- Introduction to synthesis of mechanisms.

ME304 Refrigeration, Airconditioning & Heat Transfer Lab.	
3 Lecture hours per week (3+2) 5 units	Prerequisite: ME212, ME311
Contents:	
• Experiments with refrigerator and heat pump. • Radiation and natural convection experiments. • Study and working of airconditioning unit. • Cross flow heat exchangers. • Vortex of flow experiment. • Air motor test etc.	

ME305 Fluid Mechanics I	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME211, ES216
Contents:	
• Fundamental principles governing fluid flow, including conservation of mass, momentum and energy and its application to engineering problems. • The course covers: fluid properties, fluid statics, fluid flow concepts and basic equations, dimensional analysis and dynamic similitude, viscous effects (flow through pipes, boundary layers, forces on immersed bodies). • Digital computer programmes are used in solving some practical engineering applications such as pipe-flow problems.	

ME306 Fluid Mechanics II	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME212, ME305
Contents:	
• Multi-dimensional flow of inviscid fluids: Equation of motion; rotational and irrotational flows; potential plane flows; conformal mapping; flow nets. • Basic principles of compressible fluid flow: Perfect-gas relations; isentropic flow; shock waves, adiabatic flow with friction in conduits; frictionaless flow through ducts with heat transfer. • Turbomachinery: Elementary cascade theory, theory of turbomachines; impulse and reaction turbines, pumps and blowers.	

ME311 Heat Transfer	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME211, ES201
Contents:	
• Concepts in heat transfer and methods of analysis. • Steady one dimentional heat transfer, extended surfaces. • Steady two dimensional heat transfer, shape factors. • Unsteady heat conduction in one or more dimensions, lumped heat capacity, charts, product solutions. • Numerical methods in steady and unsteady conduction. • Fundamentals of convection, non-dimensional parameters. • Forced convection. • Analogies between momentum and heat transfer. • Free convection. • Heat exchangers. • Radiation physics. • Radiative exchange between black surfaces and between grey surfaces. • Radiation circuits. • Radiation and convection.	

ME314 Elements II	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES211
Contents:	

- Design analysis of the shaft couplings and clutches.
- Introduction to the friction and wear theory.
- Bearings: Rolling bearings; calculation models.
- Examples of correct design of bearing systems.
- Journal bearings.
- Bearings with fluid and mixed friction.
- Construction and calculations of journal bearings.
- Spur gears.
- Geometry of gearing.
- Determination of teeth load.
- Design analysis of gear trains.
- Planetary gear trains, constructional arrangements.
- Bevel, worm and helical gears.
- Computer method application for optimum design of machine elements. (selected problems)

ME316 Dynamics of Machinery	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME303
Contents:	

- Static force and moment analysis; analytical and graphical methods, superposition principle typical members, frictional analysis, dynamic analysis, dynamics of rigid bodies, center of percussion, shalking forces and moments.
- Vibration analysis; critical speeds and resonance, vibration isolation and absorption, balancing; static and dynamic balancing, balancing machines.
- Dynamics and balancing of reciprocating engines, flywheel selection, dynamic analysis cam mechanisms.
- Governors.

ME212 Thermodynamics II	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES211
Contents:	

- Mixtures: General considerations, Dalton's, Amagat model of a mixture of gas and a vapor, psychrometric chart.
- Combustion: Fuels, combustion process, enthalpy of formation, adiabatic flame temperature, heat of reaction, Bomb and Junker's calorimeters.
- Thermodynamic cycles: Carnot, Rankine, Reheat, Otto, Diesel, Dual, Brayton, Vapour compression refrigeration, ammonia-absorption refrigeration cycles.
- Thermodynamic relations: Maxwell relations, relations involving; enthalpy, internal energy and entropy, thermodynamic tables.

ME323 Strength of Materials II	
4 Lecture hours per week (4+6) 10 units	Prerequisite: ME222
Contents:	

- Review of stress, equilibrium equations.
- Review of complex strain.
- Stress relations.
- Analysis of torsion: Non circular sections, torsion stress functions; hollow sections.
- Selected problems of beam calculations.
- Thick walled cylinders; compositetubes; contact stresses.
- Rotating discs of uniform thickness.
- Curved beams, energy methods; impact loads.

ME324 Machine Design Project	
2 Lecture hours per week (2+1) 9 units3	Prerequisite: ME301, ME314*
Contents:	
• Examples of simple design projects. • Lorry jacks, screw press with hand drive, steel rope brakes, shafts, couplings etc. • Project consists of: Calculations, proving the selected solution correctness, assembly drawing as well as some working drawings. Note: Number of the projects to be worked out by a student are not less than two. * may be taken as a corequisite.	

ME325 Strength of Materials Lab.	
3 Lecture hours per week (3+2) 5 units	Prerequisite: ME222
Contents:	
• Strength and toughness of elastic materials. • Absorption of strain energy. • Shear test; strength of joints. • Torsion of circular and non-circular shafts. • Deflection of I-Beam using single and two point loads, strength of composite beams; spring test, euler buckling load under different end conditions.	

ME401 Internet Comustion Engines	
4 Lecture hours per week (4+8) 12 units	Prerequisite: ME212
Contents:	
• Basic engine types and their operation. • Testing and dynamometers, performance factors, pressure measurement. • Combustion and the SI-engine, combustion and the CI-engine. • Fules. • Octane and cetane ratings. • Knock and the engine variables. • Fuel metering in SI-engines, elementary carburator, ignition systems. • Fuel metering in CI-engines, injection nozzles, fuel line hydraulics. • Engine characteristics. • Combustion chamber design in CI-engines. • Wankel engine, gas turbines.	

ME402 Thermal Power Plants	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME306, ME311
Contents:	
• Steam power plant cycle; fossil fuels, steam generators, boiler maintenance, steam turbines and components, gas turbine and steam combination cycles. • Economics of power plants, optimisation problems and control power equipment.	

ME405 Hydraulic Machines	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME306
Contents:	
• Hydraulic pumps: Pumps classification. • Theory of centrifugal pump: theoretical head; theoretical characteristics curves; actual flow through impeller. • Design of centrifugal pump: Dimensional analysis and similitude;	

design parameters and design procedure; design of volute casing.

- Pump performance: Loss in pumps; characteristic curves; pump operation; suction conditions and cavitation.
- Pump systems: System head curves, operating point, capacity control.
- Hydraulic turbines: Analysis and design of Pelton Wheel; radial flow and axial flow turbines, turbine performance.
- Computer programmes are used in solving some problems specially design problems.

ME406 Automatic Control	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES201
Contents:	

- Review of complex variables and laplace transforms. Block diagrams.
- Feedback control, stability of linear feedback control systems, root locus method, frequency response methods, stability in frequency domain.
- Design and compensation of feedback control systems.
- Introduction to advanced topics in automatic control.

ME407 Refrigeration and Airconditioning	
3 Lecture hours per week (3+9) units	Prerequisite: ME311
Contents:	

- Introduction.
- Vapor-compression cycle.
- Multipressure vapor-compression systems.
- Components of vapor-compression on systems: compressors.
- Condensers, expansion devices, evaporators.
- The complete vapor compression system.
- Psychrometry, cooling towers and evaporative condensers.
- Cooling and dehumidifing coils.
- Air-conditioning calculations.

ME408 Corrosion Control	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME204
Contents:	
• Principles of corrosion, electrochemical mechanisms, oxidation and hot corrosion, mechanical aspects of corrosion, corrosion in natural environments. • Corrosion prevention, metallic coatings, organic and inorganic coatings, corrosion inhibitors, electro-chemical methods of protection, materials selection. • Corrosion testing and simulation, economics of corrosion, modern experimental techniques.	

ME409 Heat Laboratory	
3 Lecture hours per week (3+2) 5 units	Prerequisite: ME212, ME305, Corequisite: ME401
Contents:	
• Calorific values of solid and liquid fuels using bomb calorimeters. • Calorific value of gaseous fuels using Junker's calorimeter. • Flash and fire point of various fuels. • Viseosity measurement by means of Redweed's and Saybolt's viscosimeter. • Performance tests of diesel, gasoline, two stroke-engines, gas turbine, steam turbine, rankine steam engine, stirling engine, air compressor, rocket, ramjet and steam boiler plant.	

ME419 Fluid Mechanics Laboratory	
3 Lecture hours per week (3+2) 5 units	Prerequisite: ME306, Corequisite: ME405

Contents:

- Determination of discharge coefficient of different flow meters (Orifice, venturi, rotameter).
- Determination of friction losses in pipes and pipe bends (Laminar & Turbulent flow).
- Determination of drag forces and pressure distribution around immersed bodies (cylinder, air-ofoil).
- Study of flow in an open channel (flow over weirs, hydraulic jump).
- Performance of centrifugal pump.
- Performance of an axial pump performance of positive-displacement pumps.
- Performance of Pelton Wheel.
- Performance of Francis and or Kaplan turbine.
- Caviation test.

ME421 Project I	
4 Lecture hours per week (4+4) 8 units	Prerequisite:*

Contents:

- Project courses allocated to the students cover several fields such as design, thermal sciences, manufacturing processes, material science etc.
- The topics offered take into consideration the problems existing in local industry.
- The project consisting of two parts is assigned to each student, where suitable data collections, creative thinking, proper method of calculations, decision-making abilities and set of technical drawings are the prime requirements.
- The project results are presented on specially arranged seminars.

Note: * project can be taken only by the students who are likely to graduate in two semesters and according to departmental decisions in this regard..

ME422 Project II	
6 Lecture hours per week (6+12) 18 units	Prerequisite: ME421
Contents:	
(Continuation of ME421)	

Elective Courses

ME430 Solar Energy Systems	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME306, ME311
Contents:	
• Study of the fundamentals of Solar Radiation, calculation and measurement of insolation. • Theory, performance and design of Flat-plate collectors. • Concentrating type collectors. • Uses of solar energy: Power production, buildings and water heating. • Solar thermal systems.	

ME432 Desalination Plants	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME212, ME305
Contents:	
• Water quality standards, desalination processes and their applicability (eistillation, electrodialysis, reverse osmosis) multi-stage flash distillation. • Applications of desallination, conjunctive use, domestic use. • Combined power and water production plants.	

ME434 Petroleum Engineering
3 Lecture hours per week (3+6) 9 units
Contents:
• Mechanics of rock breakage and rock drilling, basic principles of cable tool drilling and rotary drilling, general methods and equipments. • Rotary drilling liquids and hydraulics. • Well completion. • Transportation of crude oil and natural gas. • Design factors, construction of pipelines, maintenance, power requirements, pumps, compressors, tanks, loading terminals.

ME436 Air Pollution Control
3 Lecture hours per week (3+6) 9 units
Contents:
• Introduction to the problem of air pollution. • Sources of air pollution. • Air quality criteria. • Effects of air pollution on human, animals, vegetation and minerals. • Instrumentation for measuring the various pollutants. • Automotive pollution. • Control of air pollution for the present sources. • EPA standards. • Alternate strategies for future.

ME440 Motor Vehicles and Tractors	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME314, ME401, ME405
Contents:	
• Forces acting on a motor vehicle. • Traction dynamics of a motor vehicle. • General design. • Classification of motor vehicles. • Vehicle layout.	

- Suspension system.
- Steering system.
- Final drive and differentials.
- Brakes.
- Transmission.
- Forces created by implements.
- Types and special properties of tractors.

Courses for IE Students only

ME213 Thermal Engineering	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES111
Contents:	

- Units.
- Properties of pure substances.
- Perfects gas laws.
- First law of thermodynamics.
- Second law of thermodynamics.
- Standard cycles.
- Refrigerator and heat pump.
- Mixtures.
- Combustion of fuels.
- Internal combustion engines.
- Carburation.
- Ignition.
- Injection.
- Steam boilers.
- Steam turbines.
- Jet engines, rockets.
- Ramjets.

ME312 Mechanics & Hydraulic Machines	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ES216
Contents:	
• Basic laws governing fluid flow and its application to engineering problems. • Basic theory of hydraulic machinery, its performance and application. • Fluid properties, fluid statics, continuity equation, Bernoulli's equation, momentum equation, flow in pipes, basic theory of turbomachinery, hydraulic turbines, positive and centrifugal pumps, performance and application of pumps.	

ME443 Heat Exchangers Design	
3 Lecture hours per week (3+6) 9 units	Prerequisite: ME306, ME311
Contents:	
• Heat exchangers types and construction; review of fundamental concepts from heat transfer, liquid, gas to gas, liquid to gas heat exchangers, boiler and condensers. • Calculation of pressure drop across different components of heat exchangers.	