ME Department - B.Sc. Course Description

**0904131 Engineering Graphics**  
3 Credit Hours  
Prerequisite: None  

**0904202 Computer Programming for Engineers**  
2 Credit Hour  
Prerequisite: 1901102  
A systematic development of programming via flowcharts and pseudo codes; The course highlights include: assignment, repetition, decision making, arrays, file processing and subprograms in program construction. Program design includes: algorithm design, procedures and data program structure, module design, programming standards, program documentation, testing, debugging, verification and validation, file organization and processing, array processing, abstract data structures, data driven programs and simulation. Matlab language will be used. Homework problems and projects of direct engineering applications will be assigned.

**0904221 Engineering Mechanics**  
3 Credit Hours  
Prerequisite: 0301101+0302101  
Force systems; resultant, moment of a force, equivalent force-couple system. Particle and rigid body equilibrium in one plane. Trusses and Frames. Beams; shear force and bending moment diagrams. Center of gravity and centroid. Area moment of inertia. Planar kinematics and kinetics (Newton's second Law and work-energy method) of particles and rigid bodies in rectilinear and curvilinear motion (normal and tangential coordinates).
0904222  Dynamics  3 Credit Hours
Prerequisite: 0901242
Kinematics of particles; Rectilinear and curvilinear motion in various coordinate systems. Kinetics of particles; Newton’s second law, Central force motion, Work-energy equation, Principle of impulse and momentum, Impact, Conservation of energy and momentum, Application to a system of particles. Kinematics of rigid bodies; Relative velocity and acceleration, Instantaneous center, Analysis in terms of a parameter. Plane kinetics of rigid bodies with application of Newton’s second law, Energy and impulse-momentum.

0904233  Machine Drawing  1 Credit Hour
Prerequisite: 0904131
Mechanical engineering drawing conventions and abbreviations, various systems of size description, including precision dimensioning, fastening elements, standard organization and preparation of engineering drawings, assembly and detailed drawings, design applications.

0904248  Thermal and Fluid Science  3 Credit Hours
Prerequisite: 0302102

0904249  Thermal and Fluid Science Lab.  1 Credit Hour
Prerequisite: 0904248
0904302  **Engineering Numerical Methods**  3 credit Hours
Prerequisite: 0904202

0904312  **System Dynamics and Vibrations**  3 Credit Hours
Prerequisite: 0301202
Modeling of mechanical systems (using Newton's second law and energy method). Modeling electrical, thermal, fluid and mixed systems. Examples and applications of Block diagrams system representation and simulation (Simulink or Labview). Review of Laplace transforms, Laplace based analysis of first, second and higher order systems (transient and steady state) in time and frequency domains (frequency response functions). Case studies: base motion, rotating unbalanced, suspension system, … etc.

0904314  **Dynamics and Vibrations Lab.**  1 Credit Hour
Prerequisite: 0904312

0904331  **Mechanics of Machinery**  3 Credit Hours
Prerequisite: 0904222 or 0904312
0904341  Thermodynamics (1)  

Prerequisite: 0302102
Thermodynamic concepts and definitions, states, properties, systems, control volume; processes, cycles, and units; pure substances, equation of states, table of properties; work and heat; the first law, internal energy and enthalpy; conservation of mass; SSSF and USUF processes; the second law, heat engines and refrigerators, reversible processes, Carnot cycle; entropy, Clausius inequality, principle of the increase of entropy, Efficiencies.

0904342  Thermodynamics (2)  

Prerequisite: 0904341

0904345  Thermodynamics Lab.  

Prerequisite: 0904341 + 0904342 or Co-requisite
Experimental methods in the following : Mechanical equivalent of heat; The adiabatic exponent; Marcet boiler; Bomb calorimeter; Flow through nozzle; Refrigeration system; Air conditioning system; Heat pump and air cooler; single stage air compressor; cooling tower; Thermic unit (steam turbine power plant).

0904349  Technology of the Built Environment.  

Prerequisite: None
0904361  Fluid Mechanics (1)  3 Credit Hours
Prerequisite: 0901202 or co-requisite

0904362  Fluid Mechanics Lab.  1 Credit Hour
Prerequisite: 0904361
Experimental methods in the following systems: center of pressure; impulse momentum principle; pumps, friction losses in pipes, stream lines and flow fields, buoyancy and boundary layer theory. Radial flow fan, Water turbine, Flow measurement.

0904372  Strength of Materials (1)  3 Credit Hours
Prerequisite: 0901241 or 0904221
Axial loading, Material properties obtained from tensile tests, Stresses and strains due to axial loading, Thermal Stresses, Elementary theory of torsion, Solid and hollow shafts, Thin-walled tubes, Rectangular cross-section, Stresses in beams due to bending, shear and combined forces. Composite beams, Analysis of plane stress, Mohr’s Circle, Combined stresses, Thin-walled pressure vessels, Deflection of beams, Buckling of columns, Energy Methods.

0904374  Material Lab.  1 Credit Hour
Prerequisite: 0904372+0906275*
This laboratory serves mainly the measuring and/or determination of some material properties (strain and stress, yield stress, ultimate stress, fracture stress). Non destructive testing of materials (NDT), micro and macro examination of materials and phase diagrams for steel. It is equipped with machines for conducting tests, such as: Tension, impact fatigue, bending, creep, hardness, and photo elasticity tests.
0904411  Mechanical Vibrations 3 Credit Hours
Prerequisite: 0904222+ 0301202
Simple harmonic motion. Elements of vibratory systems. Systems with single degree of freedom and applications; damped free vibration, rotating and reciprocating unbalance, vibration isolation and transmissibility, and period excitation, systems with multiple degrees of freedom and applications, methods of finding natural frequencies.

0904412  Mechanical Vibrations Lab 1 Credit Hour
Prerequisite: 0904411
Static & dynamic balancing, centrifugal force, simple & compound pendulum, bifilar suspension, mass spring system, damping coefficient and logarithmic decrement. center of percussion, kater’s reversible pendulum, torsional free vibrations, resonance response of a single degree of freedom system. Base excitation and vibration isolation.

0904418  System Dynamics and Control 3 Credit Hours
Prerequisite: 0301202+ (0904222 or 0904312)

0904419  Control Lab. 1 Credit Hours
Prerequisite: 0904418
The lab consists of experiments that are related to: First and second order system analysis control experiments. Servo systems. Stability of dynamical systems. System identification. Design and tuning of a PID controller in closed loop systems. Simulation of systems using Simulink or Matlab.
0904422  Engineering Measurements  3 Credit Hours
Prerequisite: 0904361+ 0904418

0904424  Engineering Measurements Lab.  1 Credit Hours
Prerequisite: 0904422*
Experimental methods on the following systems: pressure measurement, flow measurement, temperature measurement, strain gauges, strain rosettes.

0904435  Machine Design (1)  3 Credit Hours
Prerequisite: 0904372
Meaning, phases, evaluation, considerations of design, stress analysis, deflection analysis, static strength and theories of failure, fatigue strength. Design of fasteners and connections; riveted joints, bolts and screws, force-deflection diagrams of bolted connections. Welded joints. Mechanical springs, helical, leaf, torsional spring shafts.

0904436  Machine Design (2)  3 Credit Hours
Prerequisite: 0904331+ 0904435

0904437  Design of Machine Elements  3 Credit Hours
Prerequisite: 0904372
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
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<tbody>
<tr>
<td>0904441</td>
<td>Heat Transfer -1</td>
<td>3</td>
<td>0301302+0904361</td>
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<td>Introduction to modes of heat transfer; one-dimensional steady state conduction; unsteady state conduction, lumped heat capacity system; introduction to convection, flow and thermal boundary layers. laminar and turbulent boundary layers; convection in internal and external flows; empirical relations for forced convection heat transfer; natural convection systems; condensation and boiling; introduction to thermal radiation.</td>
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<td>0904443</td>
<td>Thermal Power Plants</td>
<td>3</td>
<td>0904342</td>
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<td>Review of power cycles related to steam and gas turbine power plants; types and characteristics of steam power plants including various plant components; water treatment; corrosion; load management; power plant economics. Environmental aspects.</td>
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<tr>
<td>0904445</td>
<td>Air Conditioning -1</td>
<td>3</td>
<td>0904441+0904441</td>
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<td>Review of psychrometry; thermal comfort; air conditioning processes; inside and outside design conditions; heating load calculations, infiltration; cooling load calculations, solar gain; heating systems, design, layout; hot water, steam, hot air systems; under floor heating.</td>
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<tr>
<td>0904446</td>
<td>Heat Transfer lab.</td>
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<td>0904441</td>
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<tr>
<td>0904453</td>
<td>Refrigeration Systems</td>
<td>3</td>
<td>0904342</td>
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<td>Basic definitions and concepts; review of vapor compression and absorption cycles; compressors, condensers, evaporators, expansion devices; refrigerants; cooling towers; components of an absorption cycles, controls.</td>
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0904459  **Energy Conversion**  3 Credit Hours
Prerequisite: 0904342

0904462  **Fluid Mechanics -2**  3 Credit Hours
Prerequisite: 0904361
Review of basic definitions; system and control volume; Foundations of flow analysis; differential from of the basic laws; general viscous flow; boundary layer theory, Navier – Stokes equation, Blassius equation, Von Karman equation, Irrotational flow; stream function, vorticity and rotationality, Incompressible inviscid frictionless flow, 2-D Flow solutions around bodies, compressible flow; adiabatic and isentropic flow; Normal shock waves; Nozzles; Introduction to turbomachinery, centrifugal pumps.

0904466  **Turbomachinery**  3 Credit Hours
Prerequisite: 0904342, 0904361
Review of basic thermodynamics and fluid mechanics; types of turbomachines; 2-D cascades; Principles of operation of compressors and pumps; centrifugal pumps, axial-flow pumps, axial-flow turbines; and radial-flow turbines.

0904467  **Design of Sanitary Systems**  3 Credit Hours
Prerequisite: 0904361
History of plumbing systems, Basic definitions; Water sources, water quality and treatment, drinking water quality. Basic fluid mechanics principles, building cold water supply systems and design, building hot water supply systems and design. Valves in water supply systems and selection, plumbing materials; plumbing fixtures. Building soil and waste drainage systems (internal and external), traps, clean-outs, interceptors, and back water valves; indirect waste piping and special wastes; drainage systems design; vents and venting; design of storm water drains; building fire fighting systems.
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<tr>
<td>0904472</td>
<td>Strength of Materials -2</td>
<td>3</td>
<td>0904372</td>
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<tr>
<td>0904481</td>
<td>Failure and Fracture Analysis</td>
<td>3</td>
<td>0904372</td>
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<td>0904484</td>
<td>Computer-Aided Design</td>
<td>3</td>
<td>0904372 + 0904331</td>
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<td>0904493</td>
<td>Introduction to Finite Element Method</td>
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<td>0904302</td>
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0904521  Robotics  3 Credit Hours
Prerequisite: 0904331+ 0904418

0904536  Design of Mechatronics Systems  3 Credit Hours
Prerequisite: Consent of Department
Mechatronic design projects combining theoretical and practical applications with real world constrications. The designs are to incorporate sensors, actuators, microprocessor interfacing, PLC, and computer control. A formal report and demonstration setups are part of the course requirements.

0904537  Design of Hydraulic and Pneumatic Systems  3 Credit Hours
Prerequisite: 0904418 or 0908441
The objective of this course is to familiarize student with fluid power systems design control and operation. It covers the fundamentals of fluid flow, modeling and n port concepts, fluid power modulation, static and dynamic modeling of pumps, motor, control valves, transmission lines and fluid drives. It also deals with design control and operation of mechanical and electrical hydraulic servodrives with feedback. Emphasis is placed on linear hydraulic systems behavior.

0904538  Applications in Mechanical Design  1 Credit Hours
Prerequisite: 0904436
A project oriented course aimed at applying the design and selection techniques covered in machine design courses into an integrated project. Students work in teams on real life mechanical design problems.

0904541  Air Conditioning (2)  3 Credit Hours
Prerequisite: 0904445
Review of psychrometry; analysis of inside and outside design conditions; low speed air conditioning systems; cooling coils, basic cooling load analysis; by-pass systems; single duct, double and multi-duct systems; unit location and position funding; duct design, fans, energy; ventilation; control systems.
0904542  Heat Transfer (2)  3 Credit Hours
Prerequisite: 0904441
Review of basic concepts; radiation properties and processes; radiation exchange among surfaces; two dimensional steady state conduction; analytical, graphical, and numerical solutions; one-dimensional transient conduction; topics in convective heat transfer; exact and approximate problem solutions, combined entry length solution in pipe flow; heat transfer in turbulent and high speed flows; liquid metal heat transfer; freezing, melting, heat-pipe heat transfer; multimode heat transfer.

0904545  Internal Combustion Engines  3 Credit Hours
Prerequisite: 0904342

0904554  Solar Energy  3 Credit Hours
Prerequisite: 0904441
Fundamentals of solar radiation; methods of solar radiation collection; thermal systems components and analysis; transfer of collected heat; storage of collected heat; domestic hot water system; introduction to solar energy applications.
0904580  Modern Control Systems.  3 Credit Hours
Prerequisite: 0904418
State variable representation of systems, Steady state and transient response specifications, Control design to satisfy stability and time response specification, control design to satisfy stability and time response specifications, linear transformations, controller design via state space methods. Controllability and Operability, control design via poleplacement, sensitivity analysis, introduction to system identification, and stability analysis of linear systems using Lyapunov method.

0904582  Vibration and Noise Control  3 Credit Hours
Prerequisite: 0904411

0904583  Autotronics  3 Credit Hours
Prerequisite: 0904545+0904418
Design and control of Fuel Feeding system, Ignition system, Suspension system, Steering system, Brake system, Differential gear box, Navigation system, Air conditioning and Car safety.

0904594  Selected Topics in Thermal Sciences  3 Credit Hours
Prerequisite: Consent of Department
The contents of this course are outlined after the approval of the department council.

0904596  Selected Topics in Applied Mechanics  3 Credit Hours
Prerequisite: Consent of Department
The contents of this course are outlined after the approval of the department council.
0904599  Project  3 Credit Hours

Prerequisite: Successful completion of 124 Cr.Hr.

The project extends over a two-regular-semesters period. In the first semester, students (individually or in teams) are assigned engineering problems which may be theoretical, experimental or both and contains a major design component. In the first semester, the students study the problem assigned and its theoretical background, set the approach, conduct a literature review, make the problem analysis and preliminary design and write a proposal including a cost estimate and time table for implementation over the second semester. In the second semester, the students carry out detailed design, construction and testing (if any), write a comprehensive report on the work as per the format posted on the department web site. The report should include, where applicable, economical and environmental assessments. The project work is presented by the students to an examination panel who judge the work.