FRESHMAN YEAR (YEAR I) (For All Engineering Departments)

Core Courses

EMA 101: Engineering Mathematics I (Functions, Differential and Integral Calculus)
PHY 101: Physics for Engineers
COM 101: Fundamentals of Computer Programming
CME 101: General Chemistry
EMA 102: Engineering Mathematics II
ECE 102: Principles of Electronics
MEE 102: Fluid Mechanics I
MEE 104: Introduction to Material Science

Bachelor of Science (B.Sc.) in Mechanical Engineering (B.Sc. MEE)

EMA 201: Engineering Mathematics III (Numerical Methods)
MEE 203: Applied Mechanics
MEE 201: Manufacturing Processes
MEE 205: Engineering Drawing and CAD
MEE 249: Workshop Practice I
EPR 199: Internship I
EMA 202: Engineering Maths IV (Statistics and Probability)
MEE 202: Mechanical Design I
MEE 210: Mechanical Vibrations
MEE 204: Strength of Materials
MEE 248: Workshop Practice II
MEE 301: Electrical Technology
MEE 303: System Dynamics and Control
MEE 305: Fluid Mechanics II
MEE 307: Mechanical Design II
EPR 399: Internship II
EPR398: Work Experience
MEE 401: Thermodynamics
MEE 402: Heat Transfer
MEE 404: Power Electronics
EPR498: Senior Year Project

Electives Courses

MEE 403: Maintenance Engineering
MEE 405: Quality Control
MEE 407: Fundamentals of Renewable Energy
MEE 407: Refrigeration and Air-Conditioning
MEE 407: Automation

COURSE DESCRIPTION

EMA 101: Engineering Mathematics I (Functions, Differential and Integral Calculus)

Functions: Linear functions, Quadratic functions, Polynomials, Inverse functions, Circular functions, Exponential functions, Logarithmic functions, Composite functions, hyperbolic functions, Rational functions ,complex functions and curve sketching. Limits, Differentiation of functions and associated techniques. Integration of functions and associated techniques. Integrals of areas under a graph. ODEs and PDEs , their Classification, order, Analytical techniques of solving Differential Equations , Formulation of Engineering Problems in differential form. Other methods of solving differential equations: Matrix forms, Laplace transforms, Fourier series. Introduction to PDE, Fourier transforms.

PHY 101: Physics for Engineers
Introduction, Mechanics, Electricity and Magnetism, Semiconductor Physics, Waves and Oscillation, Optics and Laser.

COM 101: Fundamentals of Computer Programming
This course is intended to establish a foundation for Computer Programming with specific emphasis on Engineering problems and applications. The course will cover the introductory aspects of Object-Oriented Analysis, Design, and Implementation (using C++) techniques, along with Testing according to the specified requirements of the program. Computer Programming will be treated as part of the Engineering Process, and as such will be contextualized through the course according to the Engineering Profession.

CME 101: General Chemistry (Freshman/Foundation course)
This course designed to provide a survey of inorganic and physical chemistry and an introduction to organic chemistry. Topics studied in this course include atomic structure, covalent and ionic bonding, chemical reactions, chemical calculations, acid, base and solution chemistry, radiochemistry, electrochemistry and introduction to the chemistry of hydrocarbons.

EMA 102: Engineering Mathematics II (Linear Algebra)
Vector Algebra, Matrix Algebra: Matrices, Determinants, Systems of Linear Equations, and Linear Algebra (Vector Spaces, Bases and Dimensions, Linear Transformations and their Matrices, Change of Basis, Bilinear, Quadratic, Hermitian and Skew-Hermitian Forms, Eigenvalues / Eigenvectors, Eigenvalues of Hermitian, Skew Hermitian and Unitary Matrices).

ECE 102: Principles of Electronics
Basic concept of electronics, semi-conductors: intrinsic & extrinsic semi-conductor; P-N Junction diode, types of diode and their applications. Transistors and applications this course introduces the student to basic electrical principles of AC and DC electrical systems, electronic devices and applications. The course includes the study of electrical measuring instruments, electrical safety and protection, DC control equipment, AC control equipment, programmable logic controllers, and electrical troubleshooting.

MEE 102: Fluid Mechanics I
Basic concepts and properties of fluids, Fluid Statics: Hydrostatic pressure distribution; Application to manometry; Hydrostatic forces on submerged plane and curved surfaces; Buoyancy and stability. Fluid Kinematics: Lagrangian and Eulerian description; Deformation of fluid element; Reynolds transport theorem; Fundamentals of flow visualization. Integral Relations for a control volume: Conservation equations for mass, momentum and energy; Bernoulli equation. Conservation equations in differential form: Stream function; Velocity Potential; vorticity. Dimensional analysis and similitude: Buckingham Pi theorem; Modeling and similarity. Viscous Flow in Ducts: Reynolds number regime; Head loss and friction Factor; Laminar fully developed pipe flow; turbulent pipe flows; Flow in non-circular ducts; Minor losses in pipe systems.

MEE 104: Introduction to Material Science
Introduces the materials science field, which emphasizes the structure-processing property-performance relationships for various classes of materials including metals, ceramics, polymers, electronic materials, and magnetic materials: Topics include crystallography, structure of solids, imperfections in crystals, mechanical properties, dislocation theory, slip, strengthening mechanisms, phase equilibrium, phase transformations, diffusion, thermal and optical physical properties, and electrical and magnetic properties. Issues associated with materials selection, including economic and environmental consequences of materials choices, are also addressed. Laboratory experiments, with written memo and report submissions.

EMA 201: Engineering Mathematics III (Numerical Methods)

This course provides a physical a practical foundation for the use of numerical methods to solve engineering problems. The topics studied in this course are error estimation, Taylor series, and solution of linear algebraic equations, interpolation, linear regression, numerical integration and differentiation, initial value and boundary value problems, finite difference methods for parabolic and elliptic partial differential equations. Personal computers are extensively used in this course, and the student is expected to program the numerical analysis techniques studied. In this class, the MATLAB is used to write programs and solve problems involving the topics mentioned above.

MEE 201: Manufacturing Processes

Use of measuring (Basic concepts : Definition of terms, calibration, standards, generalized measurement systems, static and dynamic performance characteristics; Analysis of experimental data; Instrumentation for measurement of position and displacement, force, pressure, velocity, temperature, proximity and range. Concept of feedback; Open and closed loop control systems, Transducers and devices for engineering applications, digital readouts, data acquisition and processing. Metrology: Standardsslip gauges, Measurement of angles, tapers, threads, coordinates, inspection of straightness, flatness, alignment and surface finish, Gear Measurements, Measurements of various product features using Mechanical, Pneumatic, Optical and Electronic Instruments, Interferometry and use of optical flats.) and layout tools, interpretation of blueprints and drawings,identification of engineering materials. Operation of machine tools, including calculation of machiningparameters; Modern Machining; Operation of gas and MIG welding equipment; Laboratory experiments and written reports are required.

MEE 203: Applied Mechanics

This course provides a comprehensive knowledge and insight into the study of Mechanics. Topics to be covered include: Statics: equilibrium; internal and external forces, Analysis of Structures. Friction. Centroid and Center of Gravity.Mass Moment of Inertia. Kinematics, particle dynamics, (application of Newton's Laws); impulse and momentum, work, energy and power. Rigit body dynamics.

MEE 205: Engineering Drawing and CAD

Introduction to engineering drawing, Concept of lines, Orthographic Projection, Projection of points, Projection of lines, Solids of revolution, Introduction to AutoCAD/Solid edge, Drawing of 2D figures and 3D modeling,assembly & drawing using solid works.

EMA 202: Engineering Mathematics III (Probability and Statistics)

This course covers the role of statistics in engineering, 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 intervals for a single sample, and tests of hypotheses for a single sample.

MEE 202: Mechanical Design I

Design of gears – Spur, Helical, Bevel and Worm gears – Design of multistage speed reducers. Design of shafts, keys, couplings, journal bearings – Selection of rolling element bearings – Design of pin, iveted and welded joints – Screw fasteners – Power screws. Design of IC engine parts: Design of piston - Connecting rod - Crankshafts – Flywheels. Design of Springs: Helical springs –Compression and tension – Leaf springs.

MEE 204: Strength of Materials

This course introduces engineering materials and concepts Stress-Strain Analysis: Stress and strain, transformations, principal stresses, and graphical representation by Mohr's circles of biaxial and triaxial cases, the concept of Elasticity and plasticity; Hookes law, and the behaviour of simple spring systems; definitions of normal stress, shearing stress, normal strain, shearing strain; shear force and bending moment diagrams; members subjected to axial loading; members subjected to torsional loading; generalized Hooke's law including thermal strains, equations of equilibrium and compatibility, plane strain and plane stress problems, Euler critical loads for columns. Energy Methods: Strain energy principles, Castigliano's theorem. Applications to cases of axial, bending, and torsional loadings and statically indeterminate problems. Laboratory experiments and written reports are required

MEE 210: Mechanical Vibrations

Explores continued development of problem-solving ability in dynamics, free and forcedvibration of undampedand damped one and multiple-degree-of-freedom systems. Topics includes viscous and non-viscous damping, support motion, rotational unbalance, vibration isolation, vibration measuring instruments, general periodic excitation, and general excitation using numerical methods. Laboratory experiments and written reports are required.

MEE 301: Electrical Technology

Introduces the basic concepts related to circuits and circuit elements; current, voltage, and power; models for resistors, capacitors, and inductors; and circuit analysis using Kirchhoff's laws. Discusses selected topics that illustrate a variety of applications of electrical engineering, such as AC circuits and electric power, the basics of semiconductor devices with applications to transistor amplifier models, transients in circuits with energy storage, mechanical controls and mechatronics, digital signals, logic circuits, and some basic concepts of computer operations, specifically, number coding, arithmetic operations, and memory circuits.

MEE 303: System Dynamics and Control

Introduction to modeling, analysis, and control of dynamic systems.Modeling of mechanical, lectrical, and electromechanical systems.Time-domain and Laplace-Transform solutions. Block diagrams and transfer functions. Analysis and design of feedback control systems. Control system representation and characteristics. System performance specifications.Absolute stability criteria.Root-Locus andrequency response analysis and design methods. Systems compensation and controller design.

MEE 305: Fluid Mechanics II

Viscous Flow and Boundary Layer Theory: Introduction to Navier-Stokes Equations;Boundary-layer equations; Momentum integral estimates; Laminar flat plate boundary layer –Blasius equation; Displacement and momentum thickness; Boundary layers with pressure gradient; Flow separation; Turbulent flat plate boundary layers. Compressible Flow: The speed of sound; Adiabatic and isentropic steady flow - Mach-number relations, Isentropic flow with area changes; Normal-shock wave - Rankine-Hugoniot relations; Mach waves, oblique shock wave, Prandtl Meyer expansion waves; Performance of nozzles; Fanno and Rayleigh flow.
Turbomachines: Euler-equation for turbo-machines; Impulse turbine- Pelton wheel; Reaction

turbine- Francis turbine, propeller turbine; Centrifugal pump; Performance parameters and characteristics of pumps and turbines; Cavitation; Net positive suction head (NPSH); Role of dimensional analysis and similitude; Positive displacement pumps.

MEE 307: Mechanical Design II

Failure analysis and design of machine components: topics includes : Stress review; Stress analysis; Static failure theory; Fatigue failure (fully reversed and fluctuating loads); Dynamic shaft design; Gears; Springs; Bearings.

EPR 398: Junior Year Project

Each student will be assigned any of the following project/thesis work:
(a) Industrial case study
(b) Preparation of a feasibility report
(c) Thesis by experimental research, and
(d) Design and development of equipment.Each report must contain student's own analysis or design presented in the approved format.
Session marks will include:
(a) Evaluation of the student's progress,
(b) Degree of involvement and participation,
(c) Merit of the project,

MEE 401: Thermodynamics

Available and reversible work, machine and cycle processes; real gas behavior; nonreactive gas mixtures; reactive mixtures; and thermodynamics of compressible fluid flow. Laboratory experiments and written reports are required.

MEE 402: Heat Transfer

A treatment of conductive, convective, and radiative energy transfer using control volume and differential analysis and prediction of transport properties, Heat exchanger; Laboratory experiments and written reports are required.

MEE 404: Power Electronics

An introduction to switched-mode dc-dc converters: the course treats basic circuit operation, including steady state converter modeling and analysis, switch realization, discontinuous conduction mode, and transformerisolated converters. Laboratory experiments and written reports are required.

EPR498: Senior Year Project

Part I of the two-semester capstone design project sequence. Senior students select a project with multiple realistic constraints, develop the necessary technical background, and write a proposal, progress reports, and a preliminary design report. Includes an oral presentation on the development and progress of the project. Part II Students complete the project design, incorporating engineering standards, build and test a prototype, write a mid-term report and a final design report, and give an oral presentation

MEE 403: Maintenance Engineering

This course introduces the concepts and utilization of maintenance as applicable to industrial and service systems. The course also covers types of maintenances systems, maintenances activities, and performance measurement for maintenance system improvement.

MEE 405: Quality Control

Quality is one of the key competitive advantages in many enterprises. It is a powerful strategic business weapon in highly competitive markets. This course introduces the basic concepts of quality control as well as the need touse statistical analysis in quality control and improvement. Advanced quality control techniques and various sampling techniques for quality inspection are also covered.

MEE 407: Automation

This course introduces students to the concepts and components that constitute an industrial automation system in manufacturing. The basic knowledge on tools and methods used for realization, analysis and assessment of automation systems are also covered.

MEE 407: Refrigeration and Air-Conditioning

Psychrometry; Heating- and cooling-load calculations; Air-conditioning systems; Fan and duct systems; Pumps and pumping; Cooling and dehumidifying coils; Air-conditioning controls; Vapour-compression cycles; Compressors; Condensers and evaporators; Expansion devices; Vapour-compression-system analysis; Refrigerants; Multipressure systems; Absorption refrigeration; Heat pumps; Cooling towers and evaporative condensers.

MEE 407: Fundamentals of Renewable Energy

An examination of the fundamentals and the impact of renewable energy technology, including wind, solar, hydroelectricity, and alternate fuelse required