

**SYLLABUS FOR B.TECH PROGRAMME
IN
MECHANICAL ENGINEERING**

FIRST SEMESTER

HSC11101: ENGLISH FOR SCIENCE AND TECHNOLOGY

L – T – P: 3 – 1 – 0

Language Resource Development: Using appropriate grammatical lexical forms to express meaning-accuracy, range and appropriacy to context; remedial exercises.

Reading Interpreting and using (a) written, and (b) graphic information: (a) Using (reading and writing) academic texts, articles in technical journals, instruction manuals/laboratory instruction sheets, safety manuals and regulations, and reports; and (b) Using maps, graphs, plan, diagrams, flow-charts, sketches, tabulated and statistical data.

Writing Appropriately in a range of rhetorical styles i.e. formal and informal: Writing instructions, describing objects and processes, defining, narrating, classifying exemplifying comparing, contrasting, hypothesizing, predicting, concluding, generalizing restating, reporting; note making (from books/journals); writing assignments; summarizing, expanding, paraphrasing; answering exam questions; and correspondence skills; interpreting, expressing and negotiating meaning, creating coherent written tests according to the conventions.

Receiving and interpreting the spoken word: Listening to lectures and speeches, listening to discussions and explanations in tutorials; Note taking (from lectures). Interacting orally in academic, professional and social situation; understanding interlocutor, creating coherent discourse, and taking appropriate turns in conversation. Negotiating meanings with other (in class room, workshop, laboratory, seminar, conference, discussion, interview etc).

AMC11101: MATHEMATICS – I

L – T – P: 3 – 1 – 0

Calculus-I: Indeterminate forms and L' Hospital's rule, successive differentiation of one variable and Leibnitz theorem, Taylor's and Maclaurin's expansion of functions of one variable.

Functions of several variables, partial derivatives, homogeneous functions, Euler's theorem, derivatives of composite and implicit functions, total derivatives, Jacobians, Taylor's and Maclaurin's expansion of functions of several variables, Errors and approximations, Maxima and minima of functions of two and three variables, Lagrange's method of undetermined multipliers.

Curvature and asymptotes, concavity and convexity and point of inflection.

Calculus-II: Reduction formulae, improper integrals, convergence of improper integrals, test of convergence, Beta and Gamma functions and its properties Differentiation under integral sign; differentiation of integrals with constant and variable limits; Leibnitz rule.

Evaluation of double integrals: Change of order of integration, change of coordinates, evaluation of area using double integrals, Evaluation of triple integrals, change of coordinates, evaluation of volumes of solids and curved surfaces using double and triple integrals. Mass, center of gravity and moment of inertia of two and three-dimensional bodies.

Trigonometry of Complex Number, 3D Geometry and Algebra: Function of complex arguments, Hyperbolic functions and summation of trigonometrical series.

3-D Geometry: Spheres, cones and cylinders, identification of conicoids and sketches.

Algebra: Infinite series, convergency and divergency of series. Comparison test, D' Alembert's ratio test, Raabe's test, logarithmic test, Cauchy's root test. Alternating series, absolute and conditional convergence, power series, uniform convergence.

APC11101: PHYSICS – I

L – T – P: 4 – 0 – 0

Properties of Matter: Moment of inertia of three dimensional regular bodies; Elasticity, interrelation among Elastic constants; Bending of beam; Torsion of cylinder; Special theory of Relativity, Lorentz transformation and application.

Thermal Physics: Concepts of distribution of molecular velocities; distribution laws and statistics - MB, FD and BE; mean free path; Transport phenomena- viscosity, diffusion; thermal conductivity, measurement of thermal conductivity; periodic and aperiodic flow of heat, Wiedemann-Franz law. Heat radiation, black body and black body radiation, Planck's distribution law and its application to classical distribution (Rayleigh-Jeans and Wiens) and total radiation (Stefan-Boltzmann) laws.

X-Ray Crystallography & Atomic Spectra: Co-ordination number; atomic radii, density of packing; Miller indices; atomic scattering factor, crystal structure factor, powder method; Bragg's law; X-ray emission and absorption spectra. Atomic states, L-S and J-J coupling; Fine structure of H_a line and elementary idea of alkali spectra.

Electromagnetic Theory: Maxwell's field equation; propagation of electromagnetic waves- dielectric and conducting charge free media; Energy of electromagnetic waves; Poynting's theorem and Poynting's vector.

ACC11101: CHEMISTRY

L – T – P: 4 – 0 – 0

Entropy and free energy changes in chemical processes; Gibbs-Helmholtz equation and its applications, Significance of chemical potential, fugacity and activity, phase rule and phase equilibria.

Equilibrium electrochemistry: Electric potentials at interfaces; Electrodes, electrochemical cells and their applications.

Corrosion: Chemical and electrochemical corrosion, classification, factors affecting corrosion and general methods of corrosion prevention.

Chemical dynamics: Rates of simple and complex chemical reactions; Fast reactions; Rate expressions for second order reactions; Homogeneous and heterogeneous catalysis and their importance.

Structure activity relationships in simple organic compounds and its relevance to mineral industry (with examples).

Polymer Chemistry: Types of polymerization reactions; preparation of some commercially important polymers (fibers, elastomers, adhesives and plastics); polymers in mineral industry.

Explosives: Classification; organic explosive compounds and mixtures; commercial explosives used in mineral industries.

Coal chemistry: Structure of coal; effect of heat on coal, Carbonization and pyrolysis, Recovery and purification of by-products obtained from coke ovens; Distillation of coal tar, coal chemicals.

Petroleum Chemistry: Processing of crude oil – distillation, sweetening and cracking (basic concepts); Octane number; Additives to improve the quality of diesel and petrol.

Lubricants: General characteristics; Gels, greases and solid lubricants; Reclamation of lubricants.

Environmental Chemistry: Hard and soft water, estimation of hardness of water, water pollution – causes and effects, water treatment including demineralization (basic concepts); Air pollution – causes, effects and general methods of control.

ENGINEERING MATERIALS

FMD11101: SECTION – A

L – T – P: 2 – 0 – 0

Introduction and classification of engineering materials, Structure of metals and alloys; Crystal imperfection; Iron-carbon phase diagram, Classification and properties of steel and non-ferrous metals.

Stress-strain curve of typical engineering materials; Elastic and plastic deformation; Fracture; Fatigue and creep; Failure of metals.

ACD11102: SECTION – B

L – T – P: 1 – 0 – 0

General Introduction to different types of engineering materials.

Ceramics: Properties and production of common ceramic materials for structural, dielectric, optical, semiconductor, ionic conductor and magnetic applications, introductions to advanced ceramic materials; Polymers and composites: Physical and Mechanical properties of polymers and their composites, effect of processing on properties. Applications in engineering, Cement and concrete: Types of cements, Chemical composition, Chemistry of setting and hardening, Concrete and reinforced cement concrete,

MMC11101: ENGINEERING GRAPHICS

L – T – P: 1 – 6 – 0

Drawing instruments and their uses; Indian standards for drawing; Lettering, Lines and dimensioning, Scales.

Orthographic projections: First angle and third angle projections, conventions used, orthographic projection of simple solids; Conversion of three-dimensional views to orthographic views.

Isometric projections: of simple solids, isometric views, conversion of orthographic views to isometric views; free hand sketch.

Projection of points, lines and planes: Projection of lines and planes to auxiliary planes, true lengths of lines and true shapes of planes.

Projection and section of solids to various planes and true shapes of sectioned surface. Inter penetration of solids and their projections, surface development of solids and its uses. Standard conventions for section of machine components.

Drawing of simple nuts and bolts, keys, cotters, pins. Assembly drawing of simple machine parts.

CMC11301: ENVIRONMENTAL STUDIES

L – T – P: 3 – 0 – 0

The multidisciplinary nature of environmental studies – definition, scope and importance; need for public awareness.

Natural resources: Renewable and non-renewable resources, Natural resources and associated problems, Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources.

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity and its conservation, Definition, genetic, species and ecosystem diversity, Value of diversity, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity, In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution – I: Air pollution, Sources of primary and secondary air pollutants: Industries, Automobiles, Meteorology, Climate change, Global warming, acid rain, Ozone layer depletion, Standards and air pollution indices, Monitoring and control measures.

Noise Pollution: Sources, Monitoring and control

Soil Pollution: Soil parameters and monitoring, Macro- and micro-nutrients, Soil amendments.

Environmental Pollution – II: Water pollution, Water quality parameters and their characteristics and standards, Water quality monitoring, Heavy metal pollution, Eutrophication, Deoxygenation, Disinfections, Water quality management and treatment.

Marine pollution, Thermal pollution.

Solid Waste Management: Causes, Effects and Control measures of urban and industrial wastes.

Role of an individual in prevention of pollution, Pollution case studies.

Disaster management: Floods, Earthquake, Cyclone and landslides.

Social Issues and Environmental Legislation: Sustainable development, Water conservation, Rain-water harvesting, Watershed management;

Resettlement and rehabilitation of people: its problems and concerns, Case studies

Environment ethics: Issues and possible solutions,

Nuclear accidents and holocaust, Case studies.

Wasteland reclamation, Consumerism and waste products.

Environment protection act, 1986, Air (Prevention and Control of Pollution) Act, 1981, Water (Prevention and Control of Pollution) Act, 1974, Wildlife Protection Act, 1972, Forest Conservation Act, 1980, Issues involved in enforcement of environmental legislation, Public awareness, Environmental impact assessment and management plan.

Human Population and the Environment: Environment and Human health, Human rights, Value education, Role of Information Technology in Environment and human health, Case studies.

MMC11201: WORKSHOP PRACTICE – I

L –T – P: 0 – 0 – 2

Carpentry: Timber classification, Seasoning and preservation, description and use of tools in carpentry, important joints and their uses, safety rules, simple exercises.

Smithy: Nature of work in fitting-shop, tools and their uses, safety rules, exercises involving simple hand forging operation.

Fitting: Nature of work in fitting-shop; fitting tools and their uses; safety rules; simple exercises involving making sawing, filling, drilling tapping etc.

ACC11251: CHEMISTRY PRACTICAL

L –T – P: 0 – 0 – 2/2

Standardization of HCl by titration against standard Na_2CO_3 solution, Determination of temporary hardness of water, Estimation of total hardness of water by EDTA method, Determination of iron in ferrous ammonium sulphate solution (Redox titration), Determination of copper in copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) (iodometrically), determination of percentage of chlorine in the sample of bleaching powder.

APC11201: PHYSICS PRACTICAL – I

L –T – P: 0 – 0 – 2/2

Typical experiments on determination of acceleration due to gravity, elastic constants – Young's modulus and modulus of rigidity, Measurement of thermal conductivity of bad conductors, Optical experiments on diffractions using diffraction grating.

SECOND SEMESTER

AMC12101: MATHEMATICS – II

L – T – P: 3 – 1 – 0

Vector Calculus and Fourier Series: Scalar and vector fields Differentiation of vectors, Level surfaces, Directional derivatives, gradient, divergence and curl and their physical meaning, vector operators and expansion formulae, Line, surface and volume integrations, Theorems of Green, Stokes and Gauss, Application of vector calculus in engineering problems, orthogonal curvilinear coordinates, expression of gradient, divergence and curl in curvilinear coordinates.

Fourier Series: Periodic functions, Euler's formulae, Dirichlet's conditions, expansion of even and odd functions, half range series, Parseval's formula, complex form of Fourier series.

Matrix Theory: Orthogonal Hermitian, skew-Hermitian and unitary matrices, Elementary row and column transformation, rank and consistency conditions and solution of simultaneous equations, linear dependence and independence of vectors, Linear and orthogonal transformations. Eigen values and Eigen vectors, properties of Eigen values, Cayley-Hamilton theorem, Reduction to normal forms, Quadratic forms, reduction of quadratic forms to canonical forms, signature, Matrix calculus & its applications in solving differential equations.

Differential Equations: Differential equations of first order and higher degree, Higher order differential equations with constant coefficient, Rules for finding C.F. and P.I., Method of variation of parameter, Cauchy and Legendre's linear equations.

Simultaneous linear equations with constant coefficients: Linear dependence of solution, Removal of the first derivative-normal form, change of independent variable, single integrable differential equation. Various applications of higher order differential equations in solution of engineering problem simple harmonic motion, free forced and damped oscillations of springs and electrical circuits.

Partial Differential Equations: Formation of P.D.E, Equations solvable by direct integration, Linear and non-linear equations of first order, Lagrange's equation, Charpit's method.

APC12101: PHYSICS – II

L – T – P: 3 – 0 – 0

Solid State Physics: Free electron theory; Bloch's theorem; Kroning-Penny model; Brillouin Zones; Effective mass; Conductors, insulators and semi-conductors; Hall effect; Intrinsic and Extrinsic semiconductors; Temperature variation of Fermi energy, p-n junction and Transistors; Introduction to Superconductivity.

Modern Physics: Matter waves, particle and wave packets, wave function: Uncertainty principle; Schrodinger equation, Particle in a box, hydrogen atom (radial equation). Brief idea of molecular spectra; Rigid rotator, spectra of simple molecules, rotation and rotation-vibration spectra. Laser and laser systems; application of lasers in fibre optics.

Physics of Rocks and Minerals: Minerals and rocks as solid state of matter, elastic and visco-elastic behaviour of rocks, thermal properties of rocks; Application of acoustics to mining industry; Rocks and minerals as dielectrics, electrical conductivity and electrification phenomena in rocks, Piezo-electricity; Ferro-electricity, Tribo-electricity.

Renewable Energy Resources

COMPUTER PROGRAMMING AND INFORMATION TECHNOLOGY

SECTION – A : AMD12102 – PROGRAMMING LANGUAGES

L –T – P: 3 – 0 – 0

FORTRAN LANGUAGE: Fortran Preliminaries: input and output statements: format specifications: control structures; Arrays: subprograms statement function, Function subprograms, subroutine subprograms; File processing.

C-LANGUAGE: Introduction, constants, variables and data types: operators and expressions: INPUT/OUTPUT statements: Decision making and branching: looping: Arrays: User defined functions: structures and unions: Pointers: File management; Dynamic memory allocation and linked lists, The preprocessor. Introduction to C++

SECTION – B: CSD12101 – INTRODUCTION TO INFORMATION TECH.

L –T – P: 1 – 1 – 0

Introduction to computer systems; computer basic; number system, computer architecture; system programming and operating systems;

Data base management systems- purpose of data base, data base system, data modeling; data base user and data processing.

Introduction to computer Networks; Internet; E-commerce; Multimedia, Data ware houses.

MMC12101: ELECTRICAL TECHNOLOGY

L –T – P: 3 – 0 – 0

Circuit: Network theorems (KCL, KVL, Thevenin, Norton, Maximum power transfer) applied to steady state DC circuit. Single phase AC circuits and phasor diagrams, series and parallel resonance. Three phase balanced AC circuits, phasor representation, measurement of three phase power by two-wattmeter method.

Transformer: Single phase transformer: Construction, types, EMF equation, equivalent circuit, phasor diagram, OC and SC tests, regulation, efficiency.

DC Machines: DC generator: Construction, principle of operation, EMF equation, OCC and external characteristic curves, and efficiency.

DC motors: Construction, principle of operation, torque-slip characteristics, starting, three point starter, speed control, efficiency.

AC Motors: three-phase induction motor: Construction, types, principle of operation, torque-slip characteristics, and starting methods, Introduction to synchronous motor.

EIC12101: ELECTRONICS AND INSTRUMENTATION

L –T – P: 3 – 0 – 0

Semiconductors, diodes, rectifiers, filters and Zenner regulators. Introduction to BJT, FET. Transistors, CE, CB and CC configurations, characteristics, selection of operating (equiescent) point; DC and AC load lines, Thermal stability; different types of biasing networks.

Frequency response of amplifier, feedback amplifier, direct coupled amplifiers, differential amplifiers.

OP-AMP fundamentals, linear applications of OP-AMPS; wave shaping, clippers and clampers; Feedback oscillators and use of OP-AMPS, relaxation oscillators, multivibrators.

Combinational and sequential circuits, A/D and D/A conversion.

Transducers, Analog and digital display systems.

MMC12102: ENGINEERING MECHANICS

L –T – P: 3 – 0 – 0

Statics: Principles of statics, Mechanical system isolation and systems in a plane, conditions of equilibrium, Analysis of frames and cables.

Laws of friction: Wedge, inclined plane, screw and screw jack; Belt friction; Collar friction; Centre of gravity of different sections used in engineering, Moment of inertia of plane figures, polar moment of inertia, moment of inertia of rigid bodies, laminae and composite sections.

Dynamics: Linear motion, circular motion, rotation and translation; displacement, velocity and acceleration time diagrams; D' Alembert's principle for translation and curvilinear motion; work and energy methods related to engineering systems.

Mechanical vibration of single degree of freedom system.

HSC12305: VALUE EDUCATION, HR ENVIRONMENT

L –T – P: 1 – 1 – 0

Social values and individual attitudes, work ethic; India's vision of Humanism, Moral and non-moral valuation, standards and principles, value judgment.

Rural development in India, co-operative movement and rural development.

Modernization, environmental issues, urbanization and slum, water resources, deforestation, air pollutants. Human rights, UN declaration, role of various agencies in protection and promotion of rights.

APC12201: PHYSICS PRACTICAL – II

L –T – P: 0 – 0 – 2/2

Experiments on semi-conductors – Measurement of band-gap, Hall effect experiment using He-Ne, Laser-diffraction, experiments to measure diameter of circular aperture, Polarization experiments to measure BREWSTER's angle and find refractive index, Study of X-ray emission and absorption spectra – determination of wave length, Ultrasonic experiments with ultrasonic interferometers.

MMC12201: ELECTRICAL TECHNOLOGY PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments on Thevenin's theorem, R-L-C series circuit, Single phase power measurement, O. C. and S. C. test of single phase transformer, Open circuit characteristics of D. C. generator, Three point starter, External characteristics of D. C. shunt generator, Speed control of D. C. motor.

MMC12202: ENGINEERING MECHANICS PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Coplanar concurrent force systems, Graphical solutions, Verification of laws of sliding friction, Belt friction, Screw friction, Mechanical advantage and efficiency of screw jack, Moment of inertia.

MMC12203: WORKSHOP PRACTICE – II

L –T – P: 0 – 0 – 2

Welding Shop: Nature of work in welding shop; Equipment used; Preparation joints; Simple exercises using manual, arc and gas welding; safety rules.

Machine Shop: Nature of work in machine shop; components of lathe; tools used in lathe machines; turning and drilling operations; use of verniers; safety rules; exercise on milling machine involving simple indexing.

Electrical Wiring and Fitting: Introduction to the basic elements of domestic electrical wiring, exercises on simple electric circuits, connection of various switches, bulbs and tube lights.

EIC12201: ELECTRONICS & INSTRUMENTATION PRACTICAL

L –T – P: 0 – 0 – 2/2

Introduction to electronic components and instruments used in electronic laboratory, study and use of CRO, Diode circuits (Characteristics, clippers and clampers), Study of DC power supply, Common emitter amplifier, Linear applications of Op Amp 741, Op Amp as (a) Sine wave-oscillator, (b) Multi vibrator, Logic gates and their use in realization of Boolean expressions, Study of flip-flop using NAND gates and use of flip-flops in counters, Study of flash type A/D converter.

THIRD SEMESTER

MMC13101: MECHANICS OF SOLIDS

L – T – P: 3 – 1 – 0

Concept of stress and strain at a point, One dimensional and two dimensional problems of stresses and strains, stress and strain tensors, Thermal stresses and strains, Complex stresses and strains; Two dimensional Mohr's circle of stress and strains.

Stresses in pressure vessels: thin, thick, and compound cylinders.

Shear force and bending moment diagrams, Bending and shear stresses in symmetrical beams.

Analysis of composite beams, Deflection of beams.

Force analysis of Fixed and Continuous beams.

Torsion of circular sections and thin walled tubes.

Springs : Helical and Leaf spring

Combined stresses, Strain energy concept , Yield criterion.

Buckling of columns, Riveted and welded joints.

MMC13102: APPLIED THERMODYNAMICS

L – T – P: 3 – 1 – 0

Basic thermodynamics: Work and heat transfer, First law of thermodynamics applied to closed and open systems, Second law of thermodynamics, Carnot's propositions, Clausius inequality, entropy principle.

Air standard cycles: Carnot, Otto, diesel and dual cycles.

Principle of working of 2 stroke and 4 stroke internal combustion engines, valve timing diagrams and performance testing.

Properties of steam: $T-v$, $P-v$, $T-s$, $P-T$, $h-s$ diagrams, Mollier diagram.

Steam generators: classification, construction and functioning, mountings and accessories.

Refrigeration Cycles: Basics of air, vapour compression and vapour absorption refrigeration cycles.

Vapour power cycles: Carnot and Rankine cycles, Reheat and regenerative cycles, thermal efficiency and work ratios.

Gas turbine cycles with heat exchanger and regeneration.

MMC13103: THEORY OF MACHINES

L – T – P: 3 – 1 – 0

Basic concepts: Degrees of freedom, Kinematic Constraints, Linkages, Mechanisms, Inversion of pairs.

Kinematic analysis of plane mechanism by graphical, analytical and computer aided methods.

Dimensional synthesis of linkages, Devis and Ackermann Steering Mechanisms, Hooke's joint.

Motion analysis and synthesis of Cam and Follower system.

Gearing Terminology, Spur, Helical, Worm and Bevel Gears.

Motion and Synthesis of simple, reverted and planetary gear trains, Brakes, clutches and dynamometers.

MMC13104: MACHINE DRAWING AND COMPUTER GRAPHICS

L – T – P: 2 – 4 – 0

Assembly of machine parts. Preparation of assembly drawing of simple machine parts such as couplings; joints, engine parts, etc., Drawing of parts and subassembly from assembly drawing. Limits, fits and tolerances for design and drawing of components and assemblies. Introduction to computer graphics, Graphic display devices, computer-aided drawing.

Convention for sectioning of machine components in computer graphics, Section of simple machine components.

Use of interactive menu-driven software for preparation of line drawing; graphic coordinate system; interactive computer graphic draw erase, move, rotate, mirror and hatch; introduction to mathematical concept for line, circle and curve drawing; introduction to CAD – application software.

AMC13101: MATHEMATICS – III

L –T – P: 3 – 1 – 0

Section – A: Analysis of Complex Variables: Limit, continuity and differentiability of function of complex variables. Analytic functions. Cauchy-Reimann's and Cauchy's integral theorem, Morera's theorem, Cauchy's Integral formula, Expansion of function of complex variables in Taylor's and Laurent's series, singularities and poles. Residues theorem, contour integration, conformal mappings and its application, Bilinear transformation.

Section – B: Special Functions: Frobenius method solution in series of ordinary differential equations, singular points. Solution of Bessel and Legendre equations, Bessel functions, recurrence relations for $J_n(x)$ and generating function for $J_n(x)$.

Legendre polynomial, Rodrigue's formula, orthogonality properties, generating function for $P_n(x)$. Elliptic integrals and properties.

Section – C Laplace Transform and PDE- II : Laplace transform of simple functions, first and second shifting theorems, multiplication and t- division theorems; Laplace transforms of derivatives, integrals and periodic functions.

Inverse of Laplace transform and convolution property. Use of Laplace transform in evaluating complicated and improper integrals and solution of differential equations related to engineering problems.

Partial Differential Equations - II. Classification of partial differential equations, solutions of one dimensional wave equation, one dimensional unsteady heat flow equation and two dimensional steady heat flow equation in Cartesian and polar coordinates by variable separable method with reference to Fourier trigonometric series and by Laplace transform technique.

MMC13201: MECHANICS OF SOLIDS PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Material property assessment through tension, compression, bending, torsion, hardness and impact tests, Deflection of beams, Spring characteristics.

MMC13202: APPLIED THERMODYNAMICS PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Two-stroke and four-stroke I. C. Engine models, I. C. Engine performance, boiler performance, vapour compression and vapour absorption refrigeration cycles.

MMC13203: THEORY OF MACHINES PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Epicyclic gear train, Coriolis component of acceleration, Effect of inertia on velocity and acceleration, Cam profiles, Grashof's law verification, Four-bar mechanisms, Hooke's joint, Oldham coupling.

FOURTH SEMESTER

MMC14101: FLUID MECHANICS

L – T – P: 3 – 1 – 0

Properties of fluids: Viscosity; Unit, Newton's law of viscosity, viscosity variation with temperatures; measurement of viscosity.

Pressure and its measurement: Absolute, gauge, atmospheric and vacuum pressures; manometers and mechanical gauges.

Hydrostatic force and surfaces; total pressure and center of pressure for plane, inclined and curved submerged surfaces; pressure on lock gates.

Kinematics: Types of fluid flow, rate of flow, continuity equation in three dimension, velocity potential and stream function; free and forced vortex flow.

Dynamics: Equation of motion, Euler's and Bernoulli's equations and their practical applications; venturimeter, orifice meter, pitot tube, momentum equation and moment of momentum.

Flow through orifices: Introduction, classification of orifices, concept of C_c , C_v and C_d .

Flow through notches: Introduction, classification of notches - rectangular, triangular, trapezoidal and stepped notches.

Flow through pipes: Loss of energy in friction, Darcy's and Chezy's equations, minor losses; Hydraulic gradient and total energy line, pipes in series and parallel, equivalent pipe, power transmission through pipes and nozzles.

Compressible flow: Equation of state, continuity equation and Bernoulli's equation, velocity of sound wave in fluid, Mach number.

Viscous flow: flow through pipes, flow between two parallel plates; Kinetic energy and momentum correction factor.

Impact of jets: Force exerted by a jet on stationary, hinged and moving plates; jet propulsion.

MMC14102: DYNAMICS OF MACHINERY

L – T – P: 3 – 1 – 0

Static and dynamic force analysis of machines by graphical, analytical and computer aided methods.

Dynamics of reciprocating and rotary machines.

Balancing of reciprocating and rotating machines.

Introduction to cam dynamics, governors and gyroscopes.

Free and forced vibration of single degree freedom system with and without damping.

Response to single degree freedom system to impulse, periodic and non-periodic excitation.

Critical speed of rotating shaft.

Vibration isolation, transmissibility, vibration measuring instruments.

Introduction to multi degree freedom system.

MMC14103: MECHANICAL ENGINEERING DESIGN

L – T – P: 2 – 4 – 0

General principle of design, selection of materials, factor of safety, design for strength and rigidity considerations, stress concentration, design for fatigue, eccentric loading, design of welded and riveted joints for fabricated structures and pressure vessels, bolted joints, screw, struts and columns.

Design of shaft, keys, rigid and flexible coupling, belt, chain and gear drives, clutches and brakes.

Introduction to Design of hydrodynamic, hydrostatic and rolling element bearings.

Design of spring: Tension, compression, torsion, and carriage springs.

Interference joints for force and torque transmission.

MMC14104: ELECTRICAL MACHINES AND CONTROL

L – T – P: 3 – 1 – 0

Three phase transformer: Construction, connection and operation.

Synchronous Machine: Types of alternators and operating principles. Voltage regulation of alternator, Parallel operation of alternators, synchronizing to infinite bus bars and operating characteristics, Operating principle and characteristics of synchronous motor, Damper winding, methods of starting of synchronous motor, Application of synchronous motor.

Three phase induction motor: Deep bar and double cage induction motor - Construction, operating principle and characteristics, Methods of starting and speed control of three-phase induction motor, Electric braking systems.

Control System: Introduction to control system, open-loop and closed-loop control, Laplace transformation and transfer function, Block diagram and signal flow graph, Modeling and physical systems, Transient response of first and second order system, Routh-Hurwitz stability criterion, P. I. D. Control.

AMC14101: NUMERICAL AND STATISTICAL METHODS

L – T – P: 4 – 0 – 0

A. Numerical Methods: Solution of non-linear algebraic and transcendental equation, Newton-Raphson, iterative, false position and bisection methods, Generalized Newton's method for multiple roots.

Solution of linear simultaneous equations by Gauss elimination, Gauss-Jordan, Crout's triangulrization, Jacobi and Gauss-Seidel iterative methods.

Finite difference operators and their relations, factorial notation of a polynomial, data smoothing. Newton-Gregory and Lagrange's interpolation formulae; Inverse interpolation by Lagranges and iterative methods; Cubic spline.

Numerical differentiation and integration: Trapezoidal, Simpson and Wieddle rules and Gaussian quadrature formula.

Numerial solution of first order ordinary differential equations by Picards, Taylor's. Eulers, modified Eulers, Runge-Kutta and Milne's methods; Solution of simultaneous first order and second order ordinary differential equations by Runge-Kutta and Milne's methods.

Solution of boundary value problems by finite difference method. Solution of PDE (Laplace's equation, one dimensional heat conduction and wave equations).

Computer programming of the following: (i) N-R method (ii) Iterative method, (iii) method of false position, (iv) Lagranges interpolation formulae (v) trapezoidal, Simpson and Wieddle's rules, (vi) Gauss elimination method, (vii) Gauss iteration method, (viii) Euler's and modified Euler's methods, (ix) Runge-Kutta and Milne's methods, (x) Laplace equation (xi) Heat conduction, (xii) Wave equations.

Scope of practice sessions: Execution of the above programs for solving problems.

B. Statistical Methods: Concept of frequency distribution : Moments, skewness and kurtosis

Probability: various approaches of probability-classical, frequency, statistical, subjective and axiomatic, theorems on probability, conditional probability, independence, Bayes theorem Rondon variable-discrete and continuous, Distribution functions and their properties: Probability mear and density function : Mathematical expectation/Moment generating function and its properties.

Probability distributions; Bernoulli's, binomial, negative binomial, Poisson and normal distributions.

Theory of least squares and curve fitting.

Correlation – Simple, multiple and partial, regression lines; regression coefficients; multiple and partial correlation coefficients.

Test of significance: Normal test, t-test, Chi-square test and F-test.

Introduction to non-parametric tests.

Elements of statistical quality control: Scope of practice session; Computation of raw moments; central moments, coefficients of variation, coefficients of skewness and kurtosis; fitting of straight line, second degree parabola, power curve and exponential curve; computation of product moment correlation; multiple and partial correlation coefficient. regression coefficients and regression line, plane of regression, application of tests of significance based on numerical data; mean chart, range chart and sigma chart.

MMC14201: FLUID MECHANICS PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Bernoulli's theorem, Flow through orifices and notches, Flow through pipes, Calibration of venturimeter and pressure gauges, Flow demonstration by Reynold's experiment.

MMC14202: DYNAMICS OF MACHINERY PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Cam and follower dynamics, Performance investigation of Porter governor, Static and dynamic balancing of multi-rotor system, Gyroscopic couple, Free vibration of single degree freedom system.

AMC14201: NUMERICAL AND STATISTICAL METHODS PRACTICAL

L –T – P: 0 – 0 – 2

Numerical Methods: Numerical solution of non-linear algebraic and transcendental equations by Iteration Method, Newton-Raphson Method and Method of false position; Interpolation by Lagranges Method; Numerical Integration by Trapezoidal Rule, Simpson 1/3rd & 3/8th Rule and Weddles Rule; Numerical solution of ordinary differential equations by Eulers, Modified Eulers, Runge-Kutta and Milnes' Predictor-corrector Method.

Statistical Methods: Preparation of frequency distribution table for discrete & continuous data, Ogive curves; Measures of central tendency, dispersion, skewness and kurtosis; Curve fitting of straight line, second degree polynomial, exponential and power curves; Correlation and regression lines, multiple and partial correlation; Tests of significance of mean and variance based on one & two normal populations; Quality control (Control Charts for mean & range).

FIFTH SEMESTER

MMC15101: FLUID MACHINES

L – T – P: 3 – 1 – 0

Classification and field of application of fluid machines.

Reciprocating Pumps: Classification with constructional differences, Theory, Indicator diagram, Net positive suction head, Capacity, pressure and power calculation and effect of air vessel.

Rotary Positive Displacement Pumps: Types, and constructional differences.

Centrifugal Pumps: Types, Specific speed, Euler's equation, Theoretical and actual head, Construction of impeller and casing, Multi-staging, Axial thrust balancing, Characteristic curves, Parallel and series operation, Capacity and Power calculation.

Construction and Operation of slurry, Submersible, Air lift and Mono pumps.

Water Turbines: Classification, Theory, Construction, Operation, Power calculation and governing of Pelton, Kaplan and Francis turbines.

Fans and compressors: Types, Construction, Operation and power calculation.

Selection steps and testing procedure of fluid machines.

MMC15102: HEAT AND MASS TRANSFER

L – T – P: 3 – 1 – 0

Modes and mechanisms of heat transfer.

Conduction: General heat diffusion equation, one dimensional steady state heat conduction with and without heat generation for composite slab, cylinder and sphere, critical thickness of insulation, heat transfer through extended surfaces, Fin performance, Two dimensional steady state heat conduction, numerical methods, transient conduction, lumped capacitance and numerical methods.

Convection: Forced and free convection, hydrodynamic and thermal boundary layers, mass, momentum and energy equations, non-dimensional parameters, solution for laminar over flat plates, governing equation and empirical relations for free convection, boiling and condensation heat transfer.

Heat exchangers: Parallel and counter flow heat exchangers and their performance.

Radiation: Radiation properties and laws, Kirchoff's law, radiation exchange between black and non-black surfaces, view factor, radiation shield.

Mass transfer: Fick's law of diffusion, mass diffusion equation, Equimolar counter diffusion, convective mass transfer.

MMC15103: PRODUCTION TECHNOLOGY – I

L – T – P: 3 – 1 – 0

Foundry: Types of patterns, pattern allowances; pattern materials, moulds and mould preparation; properties of moulding sand, moulding materials, casting method, elements of gating system, location of runners and risers, cores, chills, chaplets, Moulding machines, Defects in casting and remedies.

Cupola, Electric furnaces- different types.

Casting processes – Centrifugal, Semi-centrifugal, Centrifuging, Investment casting, continuous casting, shell moulding, Die casting.

Classification of solid phase welding, fusion welding, Resistance welding, Electric Arc Welding, Oxyacetylene welding and gas cutting, TIG, MIG welding. Welding defects and their causes, Soldering and brazing. Adhesive bonding.

Types of forging - hammer, press, upset, etc., forging materials, forging allowances, dies and die-blocks. Defects in forging and remedies. Extrusion processes - hot and cold, advantages and limitations of hot and cold forming.

Heat treatment processes – principle of operation.

Sheet Metal Working: Types and selection of presses for sheet metal working, sheet metal operation – cutting, forming, bending. Progressive die, compound dies, combination dies, Sheet metal punch and die, clearance and shear on punch and die, punch and die design, punch and punch mounting techniques, strippers, pilots and stops, stock layout.

MMC15104: ADVANCED MECHANICAL ENGG. DESIGN

L –T – P: 2 – 4 – 0

Rigidity, Critical speed, fatigue and creep considerations in design, Soderberg & Goodman diagram, Production considerations in design. Design of stepped shafts and crank shafts. Design of speed reducers, gearboxes and variable speed drive, Design and selection of hydrodynamic and hydrostatic bearing, Selection, design and analysis of rolling element bearing. Lubrication and wear consideration. Design and drawing of basic components of I. C. engines, machine tools etc. Concept of design project, Application of tolerance for drawing of designed parts, subassembly and assembly.

MSC15152: INDUSTRIAL ENGG. AND MANAGEMENT

L –T – P: 3 – 0 – 0

Basic functions of Management – Planning, organizing, staffing, directing and controlling, Introduction to Industrial Engineering techniques.

Productivity: definition, measurement. Work study and its role in improving productivity of an organization, Types of production system. Introduction to production planning and control.

Concepts of Human Resource Management – Selection, Training & Development.

Finance Management – Capital Budgeting Techniques. Pay-back ARR, NPV, IRR, PI, Sources of Long-term Capital, Cost concepts and Break-even analysis.

Project Management – Network construction & identification of critical activities in CPM & PERT

Introduction to Optimization Techniques, Linear Programming and its graphical solution.

MMC15201: FLUID MACHINES PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to impact of jet, Performance tests on air compressors, Centrifugal pumps, Pelton wheel, Francis and Kaplan turbines

MMC15202: HEAT AND MASS TRANSFER PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Conductivity of metal, Convective heat transfer coefficient in forced and natural convection, Emissivity, Parallel and counter-flow heat exchangers, Regenerative heat exchanger.

MMC15203: WORKSHOP PRATICE – III

L –T – P: 0 – 0 – 3

Practical classes related to Pettern making, Foundry, Sheetmetal working, Soldering, Electric arc welding, MIG welding, Plazma cutting, TIG welding, Spot welding etc.

SIXTH SEMESTER

MMC16101: INTERNAL COMBUSTION ENGINES

L – T – P: 3 – 1 – 0

Comparison of ideal, fuel-air and real cycles, Use of fuel-air cycle for engine performance prediction.

Fuel for S.I. and C.I engines and gas turbines, fuel ratings, alternative fuels, principle of carburetion, modifications and design of carburetors, Ignition systems, power advancing.

SI and CI engine combustions process, detonation and diesel knock.

Fuel injection system, fuel pump and injectors, petrol injection MPFI system.

Super-charging and turbo-charging, engine cooling and lubrication, testing and performance.

Engine emission and control methods.

Theory, construction and calculation of rotary piston and variable compression engines.

MMC16102: MECHANICAL VIBRATION

L – T – P: 3 – 1 – 0

Two-degree freedom system, Multi-degree freedom system, principle of tuned vibration absorber.

Torsional vibration – single and multi rotor system, geared system, properties of vibrating systems like stiffness matrix, mass matrix.

Approximate numerical methods for determining natural frequencies and mode shapes: Raliegth , Dunkerley, Rayleigh-Ritz, Matrix iteration.

Holzer method, Myklestad's method for beam and transfer matrices.

Introduction to vibration of continuous system. Vibration analysis of some industrial equipment.

MMC16103: PRODUCTION TECHNOLOGY – II

L – T – P: 3 – 1 – 0

Classification of metal machining processes, Tool materials, Types of tools – single point and multi point, Tool geometry, Tool nomenclature system, cutting speed, feed and depth of cut, Types of chips, Mechanism of chip formation, Merchant's theory of metal cutting, Frictional forces, Velocity relationship

Evaluation of machinability, Tool life, determination of optimum cutting speed in machining, Thermal aspects of metal machining, Chip tool interface temperature, cutting fluids.

Engine, Turret and Capstan lathes and their elements, Automatic lathes – multi spindle type, screw cutting and copying machines.

Milling machines – types and their elements, milling operations, milling cutters, dividing head and indexing, methods of gear production – gear hobbing and gear shaping machines, broaching machines. Drilling machines, boring machines, plano milling machines.

Grinding machines – different types, principle of operation, Grinding wheels, construction and materials, lapping, honing, super finishing, abrasive belt grinding.

Machine tool structure, slideways, guides, columns and spindles, Machine tool drives – different types spindle speed layout, establishment of gear ratios, Structural and ray diagrams, vibration of machine tools and chatter.

Jigs and fixtures: Types and their application for turning, milling, drilling and boring, Principles of location and clamping, tool guidance.

Nontraditional machining processes – Classification, process selection, applications, Electric discharge machining – tools and workpiece materials, di-electrics, Electro-chemical machining system – process elements and applications, Ultrasonic machining system, Abrasive and water jet machining, Laser beam machining, Plasma arc machining.

MMC16104: COMPUTER AIDED DESIGN

L –T – P: 2 – 4 – 0

Principles of interactive computer graphics, Geometric modeling, Principle of software designs, Data structure, Design process, Flowchart, coding, modular programming, Debugging and testing. Introduction to optimal design and optimization techniques for design of mechanical elements, computer aided optimum design of machine elements such as springs, shafts, bearings, gears, etc.

MMC16105: ADVANCED SOLID MECHANICS

L –T – P: 3 – 1 – 0

Three dimensional state of stress and strain, Generalised Hook's Law, Equilibrium equation and Compatibility conditions, 3-D Mohr's Circle for stress and strain, principal stresses and planes, Airy's stress function approach, Plane stress and plane strain problems, Torsion of non-circular bars, membrane analysis.

Concept and application of energy methods.

Problems on statically indeterminate beams, Unsymmetrical bending problems, Shear stresses in beams, Shear center, Shear flow in thin members, Plastic analysis of beams, Beams on elastic foundation.

Introduction to theory of plates and shells, theory of elasticity, Non-destructive testing methods.

Experimental stress analysis.

MMC16201: INTERNAL COMBUSTION ENGINES PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Petrol and diesel engine performance, Morse test, Heat balance and emission characteristics for two-stroke and four-stroke petrol and diesel engines, Indicated mean effective pressure from indicator diagram of petrol and diesel engines.

MMC16202: MECHANICAL VIBRATION PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to Forced vibration of single degree undamped and damped systems, whirling of rotating shaft, Torsional vibration, Beating phenomenon, Use of vibration measuring instruments.

MMC16203: WORKSHOP PRACTICE – IV

L –T – P: 0 – 0 – 3

Practice classes related to Turning, Milling, Drilling, Grinding, Gear shaping, Gear hobbing, CNC milling, CNC turning, CNC simulation software, Non-traditional machining processes like WIRE, EDM, ECM

SEVENTH SEMESTER

MMC17101: MEASUREMENT AND INSTRUMENTATION

L – T – P: 3 – 0 – 0

Accuracy of measurement and theory of error.

Measurement of stress, Strain, Velocity, Acceleration, Temperature, Pressure, Flow, Force, etc. by using different types of transducers.

Instrumentation amplifiers, transducers and sensors, data-acquisition system (DAS), interfacing, filters – low-pass, high-pass and band-pass filters, signal conditioning, Micro-processors and Micro-controller applications.

MMC17102: ENERGY CONVERSION EQUIPMENT

L – T – P: 3 – 1 – 0

Steam turbine: Impulse turbine, velocity and pressure combining turbine, Reaction turbine, reheating, regenerative feed heating, control of turbine.

Gas turbine: Open and closed cycle, Ideal and real cycle. Regenerative and reheat cycle, cycle with intercooler.

Nuclear power: Principle of nuclear energy, nuclear fission and fusion, reactors. Safety regulation, operation and maintenance.

MHD Power: Principle components of MHD system power calculation.

MSC17153: OPERATIONS RESEARCH

L – T – P: 3 – 0 – 0

Operation research technique and mathematical modeling – concept, classical, and applications in engineering and management problem solving. Principles of optimization, feasible and optimal solution.

Linear programming- model formulation and application, graphical method of solution., Simplex algorithm, concept of sensitivity analysis, transportation problem, formulation and solution, Introduction to assignment problems.

Queuing/waiting line model – Characteristics and parameters.

Poisson and negative exponential distribution, simulation; concept and application, Principle of Monte Carlo sampling. Network analysis in project management applying PERT/CPM – Critical path concept.

Introduction to replacement modeling and Game theory.

ELECTIVES (ANY TWO)

L – T – P: 2 × (3 – 0 – 0)

MME17101: INDUSTRIAL TRIBOLOGY

Application of tribological concept in industry; economic aspects of Tribology; basic equations of the theory of lubrications, its solution for idealized and finite bearings; calculation of oil flow rate; thermal equilibrium; types of lubricants and their applications, hydrostatic and aerostatic bearing design, theories of friction, wear and their measurement procedure; classification of wear and wear minimization techniques, concept of Terotechnology for assessing the life cycle cost of an equipment and a system of equipment.

MME17102: MECHATRONICS

Introduction to Mechatronics and measurement systems, Signal theory and engineering tools, Basics of digital technology, Transducers and sensors, Signal conditioning theory, Circuits and systems, Actuators and mechanisms, Micro-processors and Micro-controllers, Modeling, System response, Transfer function and frequency response, Principles of feedback and intelligent control, Component based system design and validation, Integration, Mechatronics design strategies.

MMC17103: WASTE HEAT UTILIZATION

Energy sources and potential for energy conservation, waste heat, sources of waste heat.

Methods of utilizing waste heat: Cogeneration, combined plants, gas turbine, steam turbine, MHD–steam, Thermoionic-steam, thermoelectric–steam plants.

Waste heat recovery systems: Heat exchangers, waste heat boilers, incineration plants, fluidized bed waste heat recovery.

Utilization of waste heat in organic Rankine cycle engine, in refrigeration and air conditioning, in heat pump systems.

Heat pipes: Working principles, different systems and application.

Thermoelectric generator and refrigeration, Energy management.

MME17104: NOISE ENGINEERING

Fundamentals of noise and noise acoustics, measuring techniques and instruments, Randomness in noise, Human response and ratings, Noise and structure, Noise in machinery, Traffic noise, Estimation and control of noise, Noise standards and legislation.

MME17105: REFRIGERATION AND AIR CONDITIONING

Air refrigeration systems, air craft air-conditioning systems and their performance.

Analysis of vapour compression cycles - simple, multi-pressure and cascade systems.

Analysis of vapour absorption systems - Aqua-ammonia, water-lithium bromide and electrolux systems.

Refrigerants and their uses, primary and secondary refrigerants, designation and properties, Ozone Depletion Potentiality (ODP) and Global Warming Potentiality (GWP) of refrigerants.

Refrigerant equipment.

Psychrometric properties and chart, Air conditioning processes, cooling load calculations, air conditioning systems and equipment. Concept of effective temperature and effective sensible heat factor (ESHF), requirement of comfort air conditioning.

Solar refrigeration and air conditioning systems.

Household refrigeration, water cooler, window air conditioner and desert coolers.

MME17106: UTILIZATION OF NON-CONVENTIONAL ENERGY

Source of energy, conventional and renewable energy, fossil fuels availability and limitations.

Solar Energy: Flat plate and concentrating collectors for liquid and gases, collection, construction area and effectiveness, solar power plants, driers, cooker and refrigeration systems.

Wind energy: Types of rotors, horizontal axis and vertical axis system, system design and site selection.

Biogas plants: Types, parameters affecting plant performance, plant design.

Tidal plants, cogeneration plants, geothermal plants, Fuel cells, thermoelectric, thermo-economics and MHD systems.

MME17107: FRACTURE MECHANICS

Stress – analysis of cracked bodies. Stress intensity factor.

Fracture toughness. Experimental determination of stress intensity factor and fracture toughness for engineering materials, J-integral, COD, CTOD concepts of fracture.

Crack Propagation and Sub-critical Crack Growth: Assessment/prediction of structural life inspection technique for locating service-cracks.

Effect of temperature on fracture.

MME17108: ADVANCED MANUFACTURING SYSTEMS

Computer integrated manufacturing (CIM) – scope, segments of CIM.

Automated process planning, code structures, generative process planning.

Group technology, Cellular manufacturing, Just-in-time in manufacturing, Flexible manufacturing system, Measures of flexibility, Lean manufacturing, Concept of agility, Agile manufacturing.

Automated guided vehicles, Application of automated guided vehicle in manufacturing systems.

Computer aided quality control in manufacturing, Non-contact inspection methodology, Inprocess and post process metrology, Coordinate measuring machines and their types.

MME17109: MECHANICAL SYSTEM DESIGN

Concept of system, system trees and their components, system properties, system feasibility and capability.

System models simulation, Design process, Design feasibility, Design audit and review. System reliability, Quality assurance and maintainability, Optimization in machinery system design, Linear programming, Human factor in systems design, System tolerance and allowance. Design of mechanical system – Case studies.

MMC17201: MEASUREMENTS AND INSTRUMENTATION PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to measurement of length, diameter, taper, angle, eccentricity, flatness, roundness, surface finish, thread, gear elements, cam profiles. Study of data acquisition systems.

MMC17202: ENERGY CONVERSION EQUIPMENT PRACTICAL

L –T – P: 0 – 0 – 2/2

Experiments related to boiler performance and heat balance, Dryness fraction of steam, Performance of steam turbine and steam condenser, Overall efficiency of thermal power plant.

EIGHTH SEMESTER

MMC18101: ADVANCE FLUID MECHANICS

L – T – P: 3 – 1 – 0

Steady Flow of Compressible Fluid: Thermodynamic relations of perfect gases, Speed of sound, Mach number and Mach cone, Normal shock waves, Fanno and Rayleigh lines, Oblique shock waves, Isentropic flow of perfect gas, Flow in a pipe with friction, Similarity between open channel flow and compressible flow.

Kinematics of Fluids: Continuum, Lagrangian and Eulerian systems, Velocity and acceleration, Equation of continuity, Equations of streamlines, Circulation, Stream function and velocity potential.

Flow of Viscous Fluids: Navier-stokes equations, Exact solutions of Navier-Stokes equations, Flow at low Reynold's numbers, Laminar boundary layer theory.

Turbulent Flow: Concept, Prandtl's mixing length hypothesis, Turbulent flow through pipes, Universal velocity law of Prandtl, Friction in smooth pipes, Turbulent flow over a flat plate, Secondary flow, Dynamic forces on submerged bodies.

MMC18102: COMPUTER AIDED MANUFACTURING

L – T – P: 3 – 2 – 0

Introduction to numerical control of machine tools, different types of control, point to point, continuous path, Digital and analogue control, Absolute and relative positioning, Adaptive machine control.

Drive actuators and feedback mechanisms used in digital control system.

Development of computer numerical control (CNC), Direct Numerical Control (DNC), Manual part programming, Computer part programming like APT, EXACT, ADAPT etc.

Economics of NC machine tools, Comparison of NC and conventional processes, Factors to be considered in their evaluation.

Industrial robots, Physical configuration, Basic robot motions and robot application.

Computer aided process planning (CAPP), different methods and application, Solid modeling and rapid prototyping.

MMC18103: AUTOMOBILE ENGINEERING

L – T – P: 3 – 0 – 0

Vehicle power: Various resistances during vehicle movement, performance curve, power calculation for vehicle.

Chassis: Different types of chassis and their construction, Placement of engine at different position on the chassis, Chassis dimensions.

Transmission: Flywheel, clutch, gearbox, universal joint, propeller shaft, Hotchkiss and torque tube drive.

Differential and final drive: Construction, function and need of differential, Final drive mechanism, Live axle, Dead axle, stub axle.

Steering: Ackerman linkage and Devis steering mechanism Component of steering system, power steering, over steering, under steering, wheel alignment.

Suspension: Different types of suspension system, leaf spring, shock absorber.

Brakes: Brake shoe mechanism, drum, disc, hydraulic and vacuum brakes, stopping distance.

Electrical equipment: Battery, ignition system, transistorized ignition system, starting mechanism.

Tyres: Construction of tyre, wheel assembly.

Auto emission: Emission standard of vehicle in India, Euro norms, emission testing.

Principle of multi-point fuel injection (MPFI), Component of MPFI, Different sensors of MPFI system; Vehicle air conditioning.

MME18101: MECHANICAL HANDLING EQUIPMENT

Introduction to various mechanical handling systems and equipment for handling unit load and bulk materials, namely: pulley blocks, winches, electric hoists, EOT cranes, bucket elevator, screw conveyor; Kinematic analysis and design features of the components; Programmable and Flexible load handling devices.

Main types of hoisting machines, Motive power of hoisting machines, load handling attachments such as hooks, tongues, grabs, ladles and brackets, lifting magnets and grab buckets.

Wire ropes, chains, lifting tackles, drums, sheaves, sprockets, Arresting gear and brakes; Couplings, Motive power units – diesel, electric; Mobile jib cranes: different types, EOT cranes, Pillar cranes, Tower cranes, Gantry cranes, radial cranes.

Hoisting and luffing mechanisms, traveling mechanism, slewing mechanism, Power transmission system; Stability of mobile crane; Automation in handling materials.

MME18102: FINITE ELEMENT ANALYSIS

Methods of FEA: Stiffness method, Potential energy and Rayleigh-Ritz method, Element formulation, Coordinate transformation, Isoparametric formulation, Principles of variational calculus.

Applications: Problems of structural mechanics, problems of dynamics and vibrations, torsion, heat conduction, bending of plates and shells.

Implementation: Computer program organization for problem solution (a short project).

MME18103: ERGONOMICS

Introduction to man-machine systems and ergonomics, Human factors in engineering, Basic ergonomics, physiological aspects of work. Work measurement through physiological cost; work physiology. Paced and unpaced work performance.

Design and selection of displays and controls. Application of anthropometric data and work place design, job design, job enrichment, rotation and satisfaction. Work-environment – physical and social. Industrial safety, Accident prevention. Training case studies.

MME18104: MAINTENANCE ENGINEERING

Maintenance – Key to equipment control.

Basic definitions, preventive, operating and shutdown maintenance; level of maintenance; factor influencing the level of preventive maintenance; evaluating PM data processing techniques for upgrading PM program; focus on implementing with examples; measuring maintenance effectiveness and maintenance control.

Application of preventive maintenance for system of equipments.

Maintenance associated with inspection, condition monitoring technique, diagnostic, maintenance techniques; Modern testing techniques; vibration and signature analysis; causes; remedy in rotating machinery.

Non-destructive testing as an aid to maintenance, principle methods, such as dye-penetrant, magnetic particle testing and ultrasonic tests, Tero-technological approach to maintenance.

Lubrication: Introduction to lubrication engineering, type, classification of lubricants with their properties and characteristics. Science of friction and wear; theories of lubrication; Bearing lubrication technique for minimization of friction and wear.

Wear: Different types of wear, such as abrasive, corrosive, seizure, scoring, scuffing, pitting, spalling, adhesive, etc. and techniques for minimization of wear with examples.

MME18105: COMPOSITE MATERIALS

Introduction to Composites: Classification, Strength and stiffness advantages, Potential usage, Basic terminology.

Macromechanical Behaviour of a Lamina: Stress-strain relations and engineering constants of anisotropic and orthotropic materials, restriction of elastic constants, stress-strain relations for a lamina of arbitrary orientation, strength and stiffness and their experimental determination for orthotropic lamina, biaxial strength theories of orthotropic lamina.

Micromechanical Behaviour: Mechanics of materials approach to stiffness, elasticity approach to stiffness, bounding techniques, solutions with contiguity, Halpin-Tsai equations, Mechanics of Materials approach to tensile and compressive strengths.

Macromechanical behaviour of a Laminate: Classic lamination theory, Laminate stiffness for symmetric, antisymmetric and non-symmetric laminates, Strength of laminates of various configuration, Inter laminar stresses, Design of laminates.

Bending, Buckling and Vibration of laminated plates: Governing equations, Solutions of simple cases, Introduction to fracture of composites.

MME18106: AUTOMATION AND ROBOTICS

Basic concepts of automation: Automatic handling of parts, using relays, positioned limit switches, etc hard automation of dedicated system of handling using in – line transfer, rotary transfer by Geneva mechanism, electro-hydraulic or pneumatic systems.

Robotics: Definition, specification, and classification of robots; application of robots in hazardous operation in open cast mines; underground mines and ocean mining operations.

Pick and place robots: Welding robots, assembly robots and maintenance robots; intelligent robots; types of sensors – tactile; vision and non tactile; gripper system. Teleoperated robots – studies of control equipment, interfacing equipment and hardware component of robots. Multi-robot systems and applications.

MME18107: POWER PLANT ENGINEERING

Thermal power plants: General layout of modern power plant. Site selection, material requirement of super thermal power plant, Coal handling, storage and feeding system, Ash handling and dust controlling, Cooling ponds and cooling towers, Feed water treatment.

Gas turbine power plant: Selection of plant – closed, open or other system, plant layout and site selection.

Nuclear power plant: Selection of plant - Fusion or Fission principle, Location of Nuclear power plant, Nuclear materials and waste disposal, Effect of nuclear radiation and safety aspects.

Hydraulic power plant: Location of plant, selection of turbine, Layout of the plant with reference to water reservoir and disposal of water, treatment of water if required. Economics of power generation.

MME18108: HYDRAULIC AND PNEUMATIC SYSTEM

Linear and rotary actuators, Valves and their characteristics, Flow forces on the valve spool, Valve design, Control actuators.

Hydraulic power pack, Torque motor, Electro-hydraulic valves, Servo valves, Design of hydraulic system for linear and rotary drives, Electro-hydraulic servo system, Pneumatic control elements, Pneumatic servo systems.

Ladder diagram, Introduction to the use of PLCs for sequence control of hydraulic circuits.

CME18151: ENVIRONMENTAL ENGINEERING

Environmental Issues, Policies and Laws.

Ecology: Ecosystem – structure and functions

Water Pollution: *Global hydrological cycle; Natural process of water purification* - Physical, chemical and biochemical processes, Pollutants classification, Stream responses to biodegradable organic waste, *Design of engineered systems for effluent treatment, disposal and reuse* – Primary secondary and advanced treatments, Sludge treatment and disposal, Waste water reuse and recycling, Disinfections of water supplies.

Air Pollution: Pollutant classification, The atmosphere, metrology and natural purification processes, Influence of metrological phenomena on air quality, Engineered systems for air pollution control, Design of air pollution control devices for particulate and gaseous contaminants.

Industrial Noise abatement and Control.

Solid Waste Management: Solid waste – types, sources and properties, Engineered systems for solid waste management – generation, in-situ handling, storage and processing, collection transfer and transport, volume reduction and component separation, Solid waste reduction recovery, reuse and recycle, Solid waste disposal – design and operation landfills, land farming and deep-wall injection.

Environmental Auditing: Introduction, types outcomes.

Environmental Management Systems: ISO 14000, Introduction, Framework and implementing strategies.