

B. Tech Mechanical Engineering

Engineers, from times immemorial, have played a crucial role in contributing to the betterment of humanity and in shaping the world by creating, developing, organizing and managing complex technologies. The growing influence of technology on all functions of society has created a good demand of Engineering graduates. The primary objective is to educate men and women for leadership in the industry and educational institutions, advance the knowledge base of the engineering professionals, and to influence the future direction of engineering practices.

Eligibility Criteria: 10+2(PCM) or equivalent in any stream

To earn a B.Tech in Mechanical Engineering a student has to earn a minimum of 180 credits. Min 100 credits to be earned from science subjects, minimum 40 credits to be earned from Mechanical Engineering subjects and remaining can be taken from any stream

Every student has to attain a minimum of D grade in all courses; a student may however, and repeat or change any course being offered. Notwithstanding, every student must acquire the desired number of credits. The detailed course structure under different categories is given in succeeding pages. Brief description of the course content follows thereafter.

Code	Subject	Credit
7.101	Mathematics-I	4
7.102	English Communication I	4
7.103	Engineering Chemistry	4
7.104	Engineering Mechanics	4
7.105	Elements of Electrical Engineering	4
7.106	Elements of Civil Engineering	4
7.107	Mathematics-II	4
7.108	English Communication II	4
7.109	Engineering Physics	4
7.110	Programming In C	4
7.111	Elements Of Mechanical Engineering	4
7.112	Engineering Graphics	4
7.113	Environmental Studies	4
7.201	Mathematics-III	4
7.202	English Communication III	4
7.203	Electrical Machine & Electronics	4
7.204	Fluid Mechanics	4
7.205	Machine Design & Industrial Drafting	4
7.206	Strength Of Materials	4
7.207	Engineering Thermodynamics	4
7.208	Mathematics-IV	4
7.209	English Communication	4
7.21	Principles of Business Management	
7.211	Theory Of Machines	4
7.212	Mechanical Measurement And Metrology	4
7.213	Internal Combustion Engine	4
7.301	Kinematics Of Machines	4
7.302	Manufacturing Processes	4
7.303	Cad	4
7.304	Fluid Power Engineering	4
7.305	Operational Research	4
7.306	Control Engineering	4
7.307	Digital Signal Processing	4
7.308	Dynamics Of Machines	4
7.309	Heat And Mass Transfer	4

7.310	CAM/CIM	4
7.311	Alternate Energy Sources	4
7.312	Power Plant Engineering	4
7.321	Energy Conservation And Management	4
7.322	Industrial Tribology	4
7.323	Quality And Reliability Engineering	4
7.324	Software Engineering	4
7.401	Automobile Engineering	4
7.402	Refrigeration And Air-Conditioning	4
7.403	Industrial Safety & Maintenance Engineering	4
7.404	Advance Manufacturing Processes	4
7.405	Machine Design	4
7.421	Gas Dynamics	4
7.422	Automobile Body Engineering	4
7.423	Machine Tool Desgn	4
7.445	Project I	4
7.446	Project II	4
7.447	Project III	4

7.101 Mathematics –I

Credit: 4

Content: Successive differentiation, Expansion of functions, Partial differentiation, Jacobian, Application of partial differentiation Matrix Eigen values And Eigen Vector

7.102 English Communication I

Credit: 4

This course is designed for the students of Engineering and Technology who need English for specific purposes in specific situations. It aims at imparting the communication skills that are needed in their academic and professional pursuits. This is achieved through an amalgamation of traditional lecture, oriented approach of teaching with the task based skill oriented methodology of learning.

Content: English Grammar Fundamentals, Reading & Comprehension, Framing Sentences and Vocabulary, Positive Outlook and Attitude, Spoken English Skills and Body Language

7.103 Engineering Chemistry

Credit: 4

This subject helps in developing problem-solving skills related to the nature of matter, chemical reactions, stoichiometry, energy transformations, atomic and molecular structure, quantum theory, chemical bonding, and periodic properties.

Content: Thermodynamics, concept of Entropy, Phase-Rule – Terminology, Water & its treatment, Corrosion and its prevention – Galvanic & concentration cell, Lubrication and Lubricants - Friction, mechanism of lubrication, Introduction to polymeric composites, polymerization, various types of polymerization, Analytical Methods - Thermal methods.

7.104 Engineering Mechanics

Credit: 4

Content: Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon's theorem, Resultant of force system Condition of static equilibrium for coplanar force system, stability of equilibrium, concept of free body diagrams, Static dry friction, simple contact friction problems, ladders, wedges, screws and belt friction, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia, Kinematics and Kinetics of Particles, work- Energy equation, Impulse – momentum, Impact – Direct central impact and oblique central impact, Kinematics and Kinetics of Rigid bodies, Plane motion,

7.105 Elements of Electrical Engineering

Credit: 4

This subject will teach high reliability soldering, desoldering, circuitry repair, plated-thru-hole repairs, conformal coating removal, industry standards, electrostatic discharge (ESD) control, surface mount device (SMD) installation, removal and replacement using hand held systems or reflow workstations. Students will solder highly reliable connections; solder to industry standards; desolder connections; install surface mount

devices; remove surface mount devices; remove conformal coatings; repair and/or replace traces, pads, and eyelets.

Content: D.C. Circuits, Nodal and Loop methods of analysis, A.C. Circuits, Transient response of RL, RC and RLC Circuits with step input, Network Theorems, Star to Delta & Delta to Star transformation, Series and parallel A.C. circuits, Three Phase Circuits, Principle, construction & working of transformer, Introduction to. D.C. Machines, Induction motor, Synchronous machines, Measuring Instruments, Voltmeter, Ammeter, Watt meter, Energy meter.

7.106 Elements of Civil Engineering

Credit: 4

Content: Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space index, Buildings- Various Components and their functions, Surveying-classification, general principles of surveying – Basic terms and definitions of chain, compass and leveling surveying, Internal and external combustion systems, Solar thermal systems – Solar photovoltaic – Solar pond – wind, wave, tidal, geothermal and ocean thermal energy conversion systems, Elements of arc and gas welding, brazing and soldering.

7.107 Mathematics II

Credit: 4

Review of the maxima & minima, point of inflexion, Asymptotes, Curve Tracing, Gamma Function & Beta Function Double and triple integral, Differential of Vector, Integration of Vector

7.108 English Communication II

Credit: 4

English Grammar Fundamentals Ii, Reading & Comprehension II, Vocabulary Building, Confidence Building And Etiquettes, Self Management

7.109 Engineering Physics

Credit: 4

It is designed to enable students to appreciate the role of physics in today's society and technology. Emphasis on the fundamental laws of nature on which all science is based, with some examples of interest to biologists.

Content: Interference, Division, Diffraction, dispersive and resolving powers. Polarization, Simple concepts of photo elasticity. Spontaneous and stimulated emissions, Laser action, Propagation of light in fibers, Simple concepts of Harmonic Oscillator, resonance; quality factor, E.M. wave theory ,dielectric coefficient permittivity, Special Theory of relativity, Nuclear physics.

7.110 Programming in C

Credit: 4

Content: This Subject provides an introduction to computer programming and to software development. The first portion of the course introduces students to computer programming, using the C/C++ language, and covers fundamental topics such as flow of

control, function definition, data structures, and object-oriented design and programming. The second portion of the course provides a more holistic view of software development and introduces students to a selection of tools, and additional languages that programmers should be proficient in to become effective software developers, with an emphasis on the Python programming language. Topics in this portion include using build tools, third-party libraries, scripting languages, and data storage.

Content: An Overview of Computer System, Operating System Basics, Introduction to the basic concepts of Networks and Data Communications, Programming Languages, C Programming language, Settings, Standard library

7.111 Elements of Mechanical Engineering

Credit: 4

Traditionally, engineering education tries to balance the fundamentals that engineers will need during their career and the skills that they need to start functioning as engineers upon graduation. The dynamic nature of the engineering enterprise makes it impossible and unwise to attempt to teach our students everything they need to know to function during their career. To restate the obvious, their education should include a strong set of fundamentals and the recognition of the need for and the ability to continually learn.

Content: Properties of Steam & Boilers, Steam Turbines and Condensers, Classification, principles, types, compounding of turbine, I.C. Engines and Gas Turbines, Water Turbines, Pumps and Hydraulic Devices, Simple Lifting Machines, Power Transmission Methods and Devices, Stresses and Strains, Bending Moment & Shear Force

7.112 Engineering Graphics

Credit: 4

Content: This subject is an introduction to engineering design and the related graphical tools used to communicate design concepts. Engineering design require a combination of organization, analysis, and communication skills. Engineering graphics is the primary medium for communicating design concepts and is an important tool for analyzing engineering problems. This subject aims at developing the skills needed for documenting designs using drawings and for performing graphical analysis of two dimensional and three dimensional problems. Manual and computer aided methods of graphical analysis and communication are covered. Topics include the following: visual thinking, engineering design, free-hand sketching, projection theory, pictorial sketching, solid modeling, engineering drawing standards, tolerancing, plotting, and computer-aided design.

7.113 Environmental Studies

Credit: 4

Introduction to Environment, Ecology and Ecosystem, Ecology & Ecosystems, Environmental Pollution, Population & Natural Resources,

7.201 Mathematics III

Credit: 4

First order ODE: Methods for solving them, homogeneous equations, exactness, methods for finding integrating factors, Linear and Bernoulli's equation, Linear differential

equations of nth order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solution of second order differential equation by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems (without derivation), Series Solution and Special Functions, Laplace Transform, Periodic functions, Trigonometric series, Fourier series of period 2π , Euler's formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series

7.202 English Communication III

Credit: 4

Advanced Grammar I, Interview Management I, English Literature Prose, Self Improvement, Business Communication

7.203 Electrical Machine & Electronics

Credit: 4

It gives engineering aspects of electric rotating machines, industrial practices of manufacture and design.

Content: Converter fed operation of DC motor, electronically commuted and permanent magnet motors, applications in electric traction, steel mill drives, etc. modelling of synchronous machines, saliency effects, steady-state and transient, brushless synchronous generators, ac motors, single phase induction motors and applications. Stepper motor and control applications in robotics.

7.204 Fluid Mechanics

Credit: 4

This subject covers various fluid systems, flow of real fluids, boundary layer theory, dimensional analysis and compressible fluid flow.

Content: Viscosity and pressure measurement and manometers, hydrostatic forces on surfaces, steady/unsteady, uniform/non-uniform, laminar, turbulent, rotational, conservation of momentum-Euler's equation, conservation of energy-Bernoulli's equation and its applications-flow of real fluids, one-dimensional viscous flow, momentum equation-forces due to pipe bends, curved tubes, sudden enlargement and contraction, flow through porous media-Darcy's equation, two-dimensional viscous flow, Navier-Stokes equations and solutions, boundary layer equations, boundary layer theory, dimensional analysis and modeling similitude, problems, compressible fluid flow.

7.205 Machine Design & Industrial Drafting

Credit: 4

This subject covers the introduction to mechanical design and various considerations/parameters, study of static loading and failure criterion, endurance strength, stress concentration factor, combined loading and design of welded joints, shafts and flywheel and springs

Content: Traditional design methods, design synthesis, design considerations and standards, engineering materials selection, manufacturing considerations, design against static loads, modes of failure, axial, bending and torsional stresses, fluctuations and

fatigue stresses, endurance limit, fatigue design under combined loading, torque requirement fluctuating loads, joints with combined stresses, differential and compound screws design, weld joints subjected to bending and fluctuating loads, design of shafts, keys and cotter design, splines and proportions, rigid and flexible coupling, flywheel designs, torque analysis, springs, classification and spring materials, design of helical springs, torsional springs, laminated springs, spring leaves.

7.206 Strength of Materials

Credit: 4

This subject covers simple and compound stresses and strains, bending moment and shear force diagrams, deflection of beams and analyses of torsional stresses and stresses in cylinders and spherical shells.

Content: Simple stress and strain, temperature stresses, complex stresses on an inclined plane under uni-axial and bi-axial stress conditions, compound stresses at a point, oblique stress, general two-dimensional stress system, principal planes, principal stresses and strains, Mohr's stress circle, Poisson's ratio, maximum shear stress, Mohr's circle, relation between elastic constants, strain energy, impact loading, types of loads and supports, S.F. and B.M. diagrams for cantilever, simply supported and over hanging beams, bending and shear stresses in beams, theory of bending, relation between curvature, slope and deflection, double integration method, Macaulay's method, moment area method, torsional stresses in shafts and springs, power transmitted, closed and open coiled helical springs, laminated springs, stresses and strains in thin cylinders and thin spherical shell.

7.207 Engineering Thermodynamics

Credit: 4

In this unit, after reviewing the laws of thermodynamics, thermodynamic relations and their applications, properties and thermodynamic cycles of liquid/vapour are studied. The knowledge is applied in the study of performance of nozzles, gas turbines and compressors.

Content: Laws of thermodynamics, thermodynamic relations, Joule-Thompson coefficient, Clapeyron equation, availability and irreversibility, steam generator and its parts, temperature entropy diagram of Rankine cycle, boiler efficiency and heat balance, use of property diagram, process of vapor in closed and open systems, determination of dryness fraction of steam, Rankine cycle, enthalpy-entropy diagrams, pressure-enthalpy diagrams, flow through nozzle, nozzle efficiency, steam turbines, velocity diagrams, stage work done, performance characteristics Carnot and Rankine cycle efficiencies, turbine isentropic efficiency, regeneration and re-heat in gas turbines, combined heat and power plants, single and multi-stage compressors, actual indicator diagrams, performance characteristics, refrigeration and heat pump cycles, simple vapour-compression and vapour absorption systems.

7.208 Mathematics IV

Credit: 4

Function of Complex variable, Complex Integration, Zeroes of transcendental and polynomial equation using Bisection method, Rate of Interpolation: Finite differences,

difference tables, Newton's forward interpolation & its problems, Newton's backward interpolation & its problems, Newton's divided difference formula for unequal intervals & its problems, Lagrange's divided difference formula for unequal intervals & its problems, Numerical integration: Trapezoidal method & its problems method, Simpson's one third and three-eighth rules & problem based on Simpson's one third and three-eighth rules. Numerical Differentiation: Solution of ordinary differential equations by following methods: Euler's Method, Picard's Method and fourth-order Runge- Kutta methods & its problems

7.209 English Communication IV

Credit: 4

Interview Management II, Presentation Skills, Writing Skills And Spoken English, Personal Development, English Literature Prose – Novel

7.210 Principles of Business Management

Credit: 4

This subject introduces basic management concepts, theories, and their application, and offers an overview of managerial concerns arising in modern organizations.

Content: Management: Definitions, Significance of management, Management and administration, Principles of Management, Evolution of management/various schools of thought, Pre-Scientific Management Era, Classical Management Era, Neo-Classical Management Era, Modern Management Era, Recent developments in management, Fundamentals of Planning, Steps of Planning, Forecasting and planning, Elements of Planning, Decision Making, functions of management, forecasting- definition, types, scheduling, organizing, staffing, Directing, Controlling, Leadership.

7.211 Theory of Machines

Credit: 4

This subject covers simple mechanisms, kinematic and dynamic characteristics of mechanisms, power transmission system elements like gears, belts ropes and chain drives, inertia forces in reciprocating parts

Content: Mechanisms, link, kinematic pair, kinematic chain, mechanism, inversion, structure, constrained motions, types of kinematic chains, single and double slider crank chains' pantograph, straight line mechanisms, approximate straight line mechanisms, steering gear mechanism and its analysis, followers and cams, motions of the follower, uniform acceleration and retardation, displacement, velocity and acceleration diagrams, cam profiles of various types of cams, toothed wheels, constant velocity ratio of toothed wheels, sliding of teeth, forms of teeth, length of contact, area of contact, interference in involute gears, methods of avoiding interference, gear trains, tabular method-algebraic method, velocity diagrams of links and mechanisms, relative velocity method, instantaneous center method, acceleration diagrams of links and mechanisms, Coriolis component of acceleration, D'Alembert's principle, Graphical method for velocity and acceleration of the reciprocating parts in steam engine or I.C. Engine, Klein's construction and its proof, thrust on the sides of cylinder walls and torque on the crank shaft, equivalent dynamical system of two masses, graphical and analytical methods for

inertia torques, open and crossed belt drives-tensions, creep and slip-power transmission, effect of centrifugal tension, virtual coefficient of friction, rope and V belt drives.

7.212 Mechanical Measurement and Metrology

Credit: 4

This subject covers study of various measuring instruments, standards of measurement, limits, fits and tolerances. It also covers linear and angular measurements.

Content: Measurement and measuring instruments, generalized measuring system, static and dynamic performance characteristics of measurement devices, calibration, concept of error, statistical analysis of errors, sensors and transducers, data acquisition system, micro-processors and PC based data acquisition systems, input-output devices, time-related measurements, strain measurements, types of strain gauges and their working, force and torque measurements measurement of temperature, measurement of pressure, measurement of flow, vibration and noise measurements, standards and measurements, limits, fits and tolerances, interchangeability, linear and angular measurements, roundness measurement, tool maker's microscope, profile project auto-collimator, screw thread measurements, gear measurement, quantitative evaluation of surface roughness and its measurement.

7.213 Internal Combustion Engine

Credit: 4

Air Standard Cycles, Carburetion, fuel Injection and Ignition systems, combustion in I.C. Engines, lubrication and Cooling Systems, Engine Testing and Performance, Air pollution from I.C. Engine and Its remedies.

7.301 Kinematics of Machines

Credit: 4

Fundamentals of theory of machines, Kinematic Analysis, Friction of a screw and nut, Brakes & Dynamometers, Inertia forces in reciprocating Parts, Gear Trains Friction wheel

7.302 Manufacturing Processes

Credit: 4

It introduces the common engineering materials and their applications.

Content: Metal casting, fabrication, forming, and metal cutting processes, surface treatment and finishing processes, Processing of wood, plastics and ceramics, Measurement and Inspection, foundry, forging, sheet metal, welding, metal cutting and fitting.

7.303 CAD

Credit: 4

This subject investigates a range of Electronic Computer-Aided Design (ECAD) packages and their implications on the design process. It allows students to evaluate the ECAD tools and to appreciate how they influence the commercial viability of products.

Content: ECAD systems, PCB, PLD and ASIC design, Software packages, VHDL programming, Design problems, Project management: use of manual and software

management techniques to maintain design integrity, appropriate design partitioning and hierarchical analysis, modern design tools.

7.304 Fluid Power Engineering

Credit: 4

Flow Through Pipes , Impact of Jet, Hydraulic Turbines, Miscellaneous Hydraulic Machines, Pumps

7.305 Operational Research

Credit: 4

This subject covers some of the models and methods used for solving operation research problems like transportation problems, sequencing, theory of games, and inventory control and network analysis.

Content: Scientific method, types of models, and general methods for solving operations research models, formulation using linear programming, graphical solution, simplex method, sensitivity analysis, optimal solution of transportation problems, sequencing problems with n-jobs and two, three and m-machines, optimal sequence algorithm, replacement of items that deteriorate with time and that fail completely, queuing models, theory of games, games without saddle points, graphical solutions, algebraic solutions to rectangular games, inventory costs, deterministic models-fixed order size systems, economic order quantity, back ordering, quantity discounts, batch-type production systems, economic production quantity multiple items, fixed order interval systems, economic order interval-single items, and multiple items, network analysis, elements of project scheduling by CPM and PERT.

7.306 Control Engineering

Credit: 4

It introduces to digital control systems, mathematical models of discrete time signals and systems, commonly used digital devices.

Content: Principles of signal conversion, sampling and reconstruction, principles of discretization, finite differences of derivatives, bilinear transformations, closed loop digital control system, transform design of digital control systems, conversion of transfer functions to canonical state variable models.

3A.307 Digital Signal Processing

Credit: 4

The main objective of this subject is to understand DSP based embedded system design methodology and applications in the fields of biotechnology, telecommunications, computer science and electronic engineering.

Content: System architecture, analog to digital conversion, Analog filtering and its limitation, Sampling theorem and quantisation, Performance metrics for A/D and D/, Fourier Transforms-FT, DFT and FFT and Z-transform, Digital filters like Windowed Sync, Moving average-FIR filter and Recursive-IIR filters, MATLAB with SIMULINK, programmable features using DSP chips as live projects for audio, development tools available for design and DSP implementation.

3A.308 Dynamics of Machines

Credit: 4

Force Analysis, Balancing, Free Vibration, Forced Vibration, Mechanisms for control

3A.309 Heat and Mass Transfer

Credit: 4

This subject deals with various modes of heat transfer-conduction, convection and radiation, estimation of heat transfer coefficients and detailed study of heat exchangers and study of boiling and accompanying mass transfer.

Content: Modes of heat transfer conduction, convection and radiation, generalized heat conduction equation in Cartesian, cylindrical and spherical coordinate systems, one dimensional steady state conduction through homogeneous and composite surfaces, shape factor, critical radius of insulation, heat conduction through fins of uniform and variable cross section, multi-dimensional steady state problems using relaxation method, transient heat conduction based on lumped parameter method, continuity, momentum and energy equations, principle of dimensional analysis, pi-theorem, boundary layer theory concepts, free and forced convection, thermal radiation monochromatic and total emissive power, absorptivity, reflectivity, Stefan-Boltzman law, Planck's distribution law, Kirchoffs law, geometrical heat factor, heat exchange by radiation between black surfaces, large parallel black plates, equal parallel and opposite black squares, black rectangles perpendicular to each other having a common edge heat exchange by radiation between large parallel planes of different emissivity, electrical network methods, heat exchangers, log mean temperature difference method, fouling in heat exchangers, different Regimes of boiling, heat transfer in condensation, Fick's law of diffusion, steady state diffusion through stationary media, steady state diffusion through stagnant gas films.

3A.310 CAM/CIM

Credit: 4

This subject explores the application of computer technology in and manufacturing . It provides students with an opportunity to develop an understanding of specialist computer applications and to apply this to their own design and development.

Content: Designing and visualizing, commercial production, and technical developments.

3A.311 Alternate Energy Sources

Credit: 4

Solar Energy, Applications of Solar Energy, Wind Energy, Biogas and Biomass, Ocean Energy, Geothermal Energy, MHD Power Plants

3A.312 Power Plant Engineering

Credit: 4

This subject covers the study of different power plants along with non-conventional energy resources and power plant economics.

Content: Sources of energy, types of power plants, selection of site for steam, hydro, nuclear and standby power plants, selection of base load and peak load power plants, variable load problems, types of high pressure steam turbines and condensers, draft and

dust removal equipment, fuel and cooling water systems, generator cooling heat balance, plant heat rates, operation and maintenance of various power plants, preventive maintenance, economics of power generation.

3A.321 Energy Conservation and Management

Credit: 4

Content: Energy, units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, Biomass energy resources, thermo chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell,

3A.322 Industrial Tribology

Credit: 4

This subject covers hydrodynamic theories and analysis of friction and other forces in the film lubrication in journal and thrust bearings.

Content: Modern theories of friction and wear, lubrication of thick, thin and mixed film type, use of various kind of lubricants, namely, fluids, solid, greases, additives, testing of lubricant, hydrodynamic lubrication theory, design considerations in journal and thrust bearings etc., wear reduction.

3A.321 Quality & Reliability Engineering

Credit: 4

This subject covers the basic concept and definition of total quality management, statistical methods in quality control, practices, employee satisfaction, relationship development, product quality and reliability.

Content: Awareness of quality, planning and control, statistical quality control, employee involvement, control charts, performance measures, flow diagram, c-chart u-chart, defects and defective, product quality and reliability, quality systems, ISO 9000-2001, failure mode and effect analysis, failure rate, total product maintenance, single sampling, double sampling.

7.324 Software Engineering

Credit: 4

Content: FAQ's about Software Engineering - Professional and Ethical responsibility, System Modeling, System Engineering process. Software products: System software, Application software, Software Requirement Analysis and Specification: Software requirements, functional and non-functional requirements, user requirements, system requirements, Requirement definition, Software requirement specification, Software Coding and Verification: Structured programming, Programming style, internal documentation, Software Project Management: Project planning, Scheduling, Risk management. Managing People: Group working, Quality planning,

7.401 Automobile Engineering

Credit: 4

This subject deals with the classification of vehicles, engine classification, and types of piston rings, engine systems, cooling and lubrication systems for I.C. engines, vehicle systems, troubleshooting and maintenance.

Content: Classification of vehicles, engine classification, firing order, flywheel, fuel supply system, emissions and pollutants, ignition system, spark plugs, magneto, vehicle systems, chassis and transmission systems, single and multi plate clutches, suspension, gearbox, troubleshooting and maintenance.

7.402 Refrigeration and Air Conditioning

Credit: 4

This subject covers principles of refrigeration along with cycles of refrigeration pertaining to vapour compression, air compression refrigeration and vapour absorption refrigeration systems. The subject also deals with classification of refrigerants and psychometry.

Content: Methods and applications of refrigeration, Carnot cycle, Bell Coleman cycle, selection of refrigeration systems for air crafts, regenerative cycle, vapour compression refrigeration cycle and its analysis, advantages over air compression refrigeration system, methods of improving C.O.P, multi compression system, classification of refrigerants, selection of refrigerants, parts of refrigeration system, absorption Refrigeration System, C.O.P. of absorption refrigeration system, comparison of vapour compression and vapour absorption system, steam jet refrigeration system ejector compression system, psychometric properties and relations, psychometric chart, factors governing effective temperature, summer, winter year round air conditioning, types of air conditioning load, by pass factor, fresh air quantity, cooling coils and dehumidifiers, air washers.

7.403 Industrial Safety & Maintenance Engineering

Credit: 4

Content: Occupational health and safety. Occupational health and hazards-physical-chemical and biological, Industrial safety and management techniques, Industrial safety standards and regulations

7.404 Advance Manufacturing Processes

Credit: 4

This subject covers various machining operations like-lathe, boring, shaping, planing, milling, drilling, boring, broaching, grinding, Jigs and fixtures. Conventional machining processes and chip formation. Unconventional machining processes like USM, AJM, EDM and EJM etc.

Content: Machine tools using single point tools, lathe operations, shaper, planer, machine tools using multi point tools, milling, drilling, broaching. Grinding, truing and dressing of grinding wheel, super finishing like honing, lapping. Work holding devices, jigs, fixtures, and magnetic chuck. Conventional machining, mechanics of chip formation, types of chip, cutting fluids, tool wear and tool life, non-conventional machining like-USM, AJM, EDM, EBM, ECM etc., differences between conventional machining and non-conventional machining.

7.405 Machine Design

Credit: 4

This subject creates an understanding of the design principles of various power transmission elements, like gears, ropes and chain drives, bearings, clutches, brakes etc.

Content: Gears of standard tooth systems, spur, helical, bevel and worm gears, Lewis equation, design for dynamic and wear loads, thermal design considerations of worm gears, design of cylinders, pistons and heads of IC engine, design of cross-head, connecting rods and crank shafts, friction clutches, torque capacity multi-plate clutches, design and energy considerations, centrifugal clutches, brakes, energy equations and brake design, sliding contact bearings, lubrication modes, temperature effect on viscosity, journal bearing design, bearing modulus, McKee equations, heating of bearings, collar and thrust bearings, roller and ball bearings, static and dynamic load capacity, equivalent bearing load, load-life relationships, load factor, design of ropes, chain drives and crane hooks, wire rope, stresses in wire ropes design for service like lifts and winches, chain drives, brief outline and simple applications of composite materials.

7.421 Gas Dynamics

Credit: 4

This subject covers concepts and analysis of compressible flow with heat transfer and frictional effects and application of such flows in jet propulsion.

Content: Basic concepts of compressible flow, one-dimensional steady isentropic flow, Fanno flow, Rayleigh flow, normal shock waves, oblique shocks, experimental methods of compressible flow, applications of gas dynamics in jet propulsion, gas dynamics analysis and performance of liquid and solid fuel propellants, rockets and ram jets.

7.422 Automobile Body Engineering

Credit: 4

Vehicle Aerodynamics, Car Body: Types, Regulations, drivers visibility, tests for visibility, methods for improving visibility and space in cars, safety design, safety requirements for car, car body construction, Bus Body Details: Types, Mini bus, single decker, double decker, two level, split level and articulated bus, Commercial Vehicle Details: Types of body, flat platform, drop side, fixed side, tipper body, tanker body, light commercial vehicle body types, dimensions of drivers seat in relation to control, drivers cab design, Body Loads: Idealized structure, structural surface, shear panel method, symmetric and asymmetric vertical loads in a car, longitudinal load, different loading situations, chassis frame design, Body Materials: Metal sheets (Steel, Aluminum etc.), plastics, timber, GRP, FRP, Composite materials, Properties of materials, corrosion, anti-corrosion methods, selection of paint and painting process, body trim items, body mechanisms.

7.423 Machine Tool Design

Credit: 4

Developments in machine tools surface, profiles and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc. General requirement of machine tool design. Machine tool design process. Tool wear, force Analysis, Machine Tools Drives

Regulation of Speed and Feed rates, Design of Machine Tool Structure, Dynamics of machine tools

7.445 Project I

Credit: 4

7.446 Project II

Credit: 4

7.447 Project III

Credit: 4