

ASSISTANT PROFESSOR MECHANICAL ENGINEERING



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EXAM DETAILS



METHOD OF RECRUITMENT

Direct

AGE LIMIT

20-39. Only candidates born between 02.01.1982 and 01.01.2001

QUALIFICATION:

BE/B.Tech and ME/M.Tech in relevant branch with First Class or equivalent either in BE/B.Tech or ME/M.Tech.

NAME OF POST

Assistant Professor
(Mechanical Engineering)

DEPARTMENT

Technical Education
(Engineering Colleges)

NUMBER OF VACANCY

Anticipated vacancies



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EXPECTED SYLLABUS

ASSISTANT PROFESSOR MECHANICAL ENGINEERING

Module 1

a) MATHEMATICS (ENGINEERING)

Matrices: Rank, systems of linear equations, consistency, eigen values, eigenvectors, Cayley Hamilton Theorem, diagonalisation, linear dependence and independence of vectors.

Partial Differentiation: Partial derivatives, Euler's theorem on homogeneous functions, total derivatives, Jacobians, Taylor's series (one and two variables) – Maxima and minima of functions of two variables – Lagrange's method.

Vector Differentiation: Scalar and vector functions, differentiation of vector functions – velocity and acceleration – scalar and vector fields – operator – Gradient – Directional derivative – Divergence – Curl – irrotational and solenoidal fields – scalar potential.

Laplace Transforms: Transforms of elementary functions, shifting property – inverse transforms – transforms of derivatives and integrals – transform of functions multiplied by t and divided by t – convolution theorem, solution of ordinary differential equations with constant coefficients using Laplace transforms.

Ordinary Differential Equations: First Order ordinary differential equations, systems of linear first order ordinary differential equations, linear ordinary differential 2 equations of higher order with constant coefficients, linear second order ordinary differential equations with variable coefficients (Cauchy and Legendre equations), Method of Laplace transforms for solving ordinary differential equations.

Complex Analysis: Analytic functions, conformal mappings, bilinear transformations, complex integration, Cauchy's integral theorem and formula, Taylor and Laurent's series, residue theorem.

Fourier Series: Fourier series of periodic functions of period 2π and $2l$, odd and even functions, Half range expansions.



b) BASIC CIVIL ENGINEERING

Mechanics – statistics – Coplanar forces – conditions of equilibrium. Support reactions – Simply supported and overhanging beams. Friction – Laws of friction – applications. Centre of gravity and moment of inertia of plane areas. Dynamics – rectilinear motion – Newton's laws of motion – curvilinear motion. Building materials – common building materials – stone, brick, cement, steel, aggregate, concrete, timber – properties, IS specification. Building construction – types and functions of the following structural components of buildings – foundations and superstructure. Surveying – principle of surveying – linear measurements using chain – levelling work – reduction of levels.

c) BASIC MECHANICAL ENGINEERING

Zeroth, first and second laws of thermodynamics, CI and SI Engines, properties of steam. Centrifugal and reciprocating pumps, hydraulic turbines, refrigeration and air conditioning, hydro-electric, thermal and nuclear power plants, mechanical power transmission systems such as belt, rope, chain and gear, manufacturing process – casting, forging, rolling, brazing, soldering, and welding, machining process – turning, shaping, drilling, grinding and milling. Conic sections and miscellaneous curves, orthographic, isometric and perspective projections.

Module II

a) BASIC ELECTRICAL ENGINEERING

Ohm's law, Kirchoff's laws – solution of series and parallel circuits with dc excitation. Magnetic circuits: MMF, field strength, flux density, reluctance, electromagnetic induction, Faraday's laws, Lenz's law, statically and dynamically induced emfs, self and mutual induction, co-efficient of coupling.

Principle of generation of alternating current – waveforms – frequency, period, average and rms values, form factor.

Generation of 3 phase ac voltage, star and delta connections, voltage & current relationships in star and delta (balanced system only).

Principle of operation of dc motor & generator, single phase transformer and three phase induction motor. Types of lamps, necessity of earthing.



b) BASIC ELECTRONICS ENGINEERING

Devices – working principle of PN junction, Zener diode and BJT.

Systems – Rectifiers : Half wave, Full wave and Bridge. Filters: Capacitors and Inductors.

Amplifiers & Oscillators – Common Emitter RC coupled amplifier and its frequency response. Principles of Wein-bridge oscillator. Op-amps: Basics, inverting and noninverting amplifier.

Communication – Need for modulation, principles of AM and FM.

Measurements – Working principles of CRO and Multimeter.

c) BASIC COMPUTER SCIENCE

Functional units of a computer.

Programming in C – control structures, functions.

Module III

Thermodynamics and Fluid Mechanics

Thermodynamic processes, entropy, irreversibility and availability, basic thermodynamic cycles, behaviour of ideal and real gases, properties of pure substances, computation of work and heat, ideal processes, analysis of thermodynamic cycles related to energy conversion.

Fluid mechanics: Fluid properties, fluid statics, manometry, buoyancy, control volume analysis of mass, momentum and energy, fluid acceleration, differential equations of continuity and momentum. Euler's equation, Bernoulli's equation, laminar flow through pipes, boundary layer displacement, momentum and energy thickness, flow through pipes, minor and major losses, dimensional analysis.

Heat transfer: Modes of heat transfer, one dimensional heat conduction, thermal resistance, fins, free and forced convective heat transfer, dimensionless parameters, problems in convective heat transfer with the help of correlation, thermal boundary layer, radiation, black and grey surfaces, shape factors, network analysis.

Mechanics of Solids: Stress-strain relationship and elastic constant, principal stress and strains, Mohr's circle for plane stresses and plane strains, shear force and bending moment diagrams, bending of beams, torsion of circular shafts, Euler's theory of columns, strain energy, thermal stresses.



Module IV

Theory of Machines

Kinematic and dynamic analysis of planer mechanisms. Cams, Gears and gear trains. Flywheels, Governors, Balancing of rigid rotors and field balancing, Balancing of single and multi cylinder engines, free and forced vibrations of single degree of freedom systems, effect of damping, vibration isolation and transmissibility, resonance, Critical speeds and whirling of shafts.

Design for static and dynamic loading, failure theories, fatigue strength and S-N diagram, Principles of design of machine elements such as bolted, riveted and welded joints. Design of shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

Module V

I.C. Engines and Refrigeration

SI and CI engines, two-stroke and four-stroke engines, efficiencies, heat balance, combustion in IC engines, abnormal combustion, engine fuels and fuel rating, alternate fuels, carburetion and fuel injection – MPFI, CRDI, super charging and turbo charging methods, engine emission and control. Steam and gas turbines, Rankine and Brayton cycles with regeneration and reheat, heat transfer equation, heat exchangers – LMTD and NTU methods, vapour compression and absorption refrigeration cycles, heat pumps, properties of moist air, psychrometric chart, basic psychrometric processes, turbo machines – impulse and reaction principles, Pelton wheel, Francis and Kaplan turbines, velocity diagram and performances of turbo machines, non conventional energy sources – solar, wind, wave, biomass, geothermal and fuel cells.

Module VI

Manufacturing Science and Processes

Classification of materials, Structure and properties of common engineering materials, Crystalline materials, crystal structure, defects in crystals, phase diagrams, iron carbon equilibrium diagram, Phase transformation, T-T-T diagram, heat treatment, fracture – brittle and ductile materials, powder metallurgy. Metal casting – sand casting, die casting, investment casting, centrifugal cast-



ing, gating and riser design, melting furnaces, forming – hot and cold processes, forging, drawing, extrusion, shearing, bending, high energy forming, joining processes –welding, weldability, metallurgy of welding, machining processes – single and multi point cutting tools, tool geometry and materials, mechanics of machining, tool life and wear, jigs and fixtures, unconventional methods, EBM, ECM, LBM, ultrasonic machining, computer integrated manufacturing, CNC machining, metrology and instrumentation – limits, fits and tolerances, accuracy, precision, repeatability, comparators, gauges, interferometry, surface structure, measurement of displacement, velocity, acceleration, temperature, Transducers.

Module VII

Principles of Management

Principles and functions of scientific management, Levels and skills of management, organisational structure – authority, responsibility and span of control – system concept of management – line, line and staff, project and matrix organizations, proprietary partnership and joint stock companies, private limited, public limited companies, cooperative organizations and Government organizations. Factors in selection of site, plant layout, types of layouts: process, product, fixed and group layouts. Marketing management – objectives and function, forecasting – moving average, exponential smoothing, break-even analysis, capacity planning, inventory control, ABC analysis, EOQ model, work study – Job evaluation and merit rating, Quality control, control charts for variables and attributes, acceptance sampling, TQM, SPC tools, ISO standards, linear programming – Graphical and Simplex solution methods, Transportation and assignment models, single server queuing models, network theory – CPM – crashing of networks, PERT – probability of completion.



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