Syllabus for ME Entrance Test (Machine Design)

ENGINEERING MATHEMATICS

Linear Algebra

Algebra of matrices, system of linear equations, eigenvalues and eigenvectors.

Calculus

Taylor Series, Fourier Series, partial derivatives, total derivatives, definite and improper integrals, multiple integrals.

Vector Calculus

Gradient, divergence and curl, line and surface integrals, Green, Gauss and Stokes' theorems.

Differential Equations

Linear ODE's, first order non-linear ODE's, initial and boundary value problems, Laplace transform, PDE's-Laplace, wave and diffusion equations.

Numerical Methods

Solution of system of linear equations, interpolation, numerical integration, Newton-Raphson method, Runge-Kutta method.

Probability and Statistics

Gaussian, Weibul distribution and their properties, method of least squares, regression analysis, analysis of variance.

APPLIED MECHANICS AND DESIGN

Engineering Mechanics

Equivalent force systems, free-body concepts, equations of equilibrium, trusses and frames, virtual work and minimum potential energy. Kinematics and dynamics of particles and rigid bodies, impulse and momentum (linear and angular), energy methods, central force motion.

Strength of Materials

Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, shear force and bending moment diagrams, bending and shear stresses, deflection of beams torsion of circular shafts, thin and thick cylinders, Euler's theory of columns, strain energy methods, thermal stresses.

Theory of Machines

Displacement, velocity and acceleration, analysis of plane mechanisms, dynamic analysis of slider-crank mechanism, planar cams and followers, gear tooth profiles, kinematics and design of gears, governors and flywheels, balancing of reciprocating and rotating masses.

Vibrations

Free and forced vibration of single degree freedom systems, effect of damping, vibration isolation, resonance, critical speed of rotors.

Design of Machine Elements

Design for static and dynamic loading, failure theories, fatigue strength -- design of bolted, riveted and welded joints -- design of shafts and keys -- design of spur gears, rolling and sliding contact bearings -- brakes and clutches -- belt, ropes and chain drives.

FLUID MECHANICS AND THERMAL SCIENCES

Fluid Mechanics

Fluid properties, fluid statics, manometry, buoyancy -- Bernoulli's equation -- Viscous flow of incompressible fluids -- Flow through pipes, head losses in pipes, bends etc.

Heat-Transfer

Modes of heat transfer -- One dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins -- Radiative heat transfer, black and grey surfaces, shape factors, network analysis -- Heat exchanger

Thermodynamics

Zeroth, First and Second laws of thermodynamics -- Thermodynamic system and processes -- Irreversibility and availability -- Behaviour of ideal and real gases, Properties of pure substances, calculation of work and heat -- Analysis of thermodynamic cycles related to energy conversion -- Carnot, Rankine, Otto, Diesel, I.C. Engines.

MANUFACTURING AND INDUSTRIAL ENGINEERING

Engineering Materials

Structure and properties of engineering materials and their applications, heat treatment. Metal Casting Casting processes (expendable and non-expendable) -pattern, moulds and cores, Heating and pouring, Solidification and cooling, Gating Design, Design considerations, defects.

Forming Processes

Stress-strain diagrams for ductile and brittle material, Plastic deformation and yield criteria, Fundamentals of hot and cold working processes, Bulk metal forming processes (forging, rolling extrusion, drawing), Sheet metal working processes (punching, blanking, bending, deep drawing, coining, spinning, Load estimation using homogeneous deformation methods, Defects).

Joining Processes

Physics of welding, Fusion and non-fusion welding processes, brazing and soldering, Adhesive bonding, Design considerations in welding, Weld quality defects.

Machining and Machine Tool Operations

Mechanics of machining, Single and multi-point cutting tools, Tool geometry and materials, Tool life and wear, cutting fluids, Machinability, Economics of machining, non-traditional machining processes.

Metrology and Inspection

Limits, fits and tolerances, linear and angular measurements, comparators, gauge design, interferometry, Form and finish measurement, measurement of screw threads, Alignment and testing methods.

Tool Engineering

Principles of work holding, Design of jigs and fixtures.

Computer Integrated Manufacturing

Basic concepts of CAD, CAM and their integration tools.

Inventory Control

Deterministic and probabilistic models, safety stock inventory control systems.

Operations Research

Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.