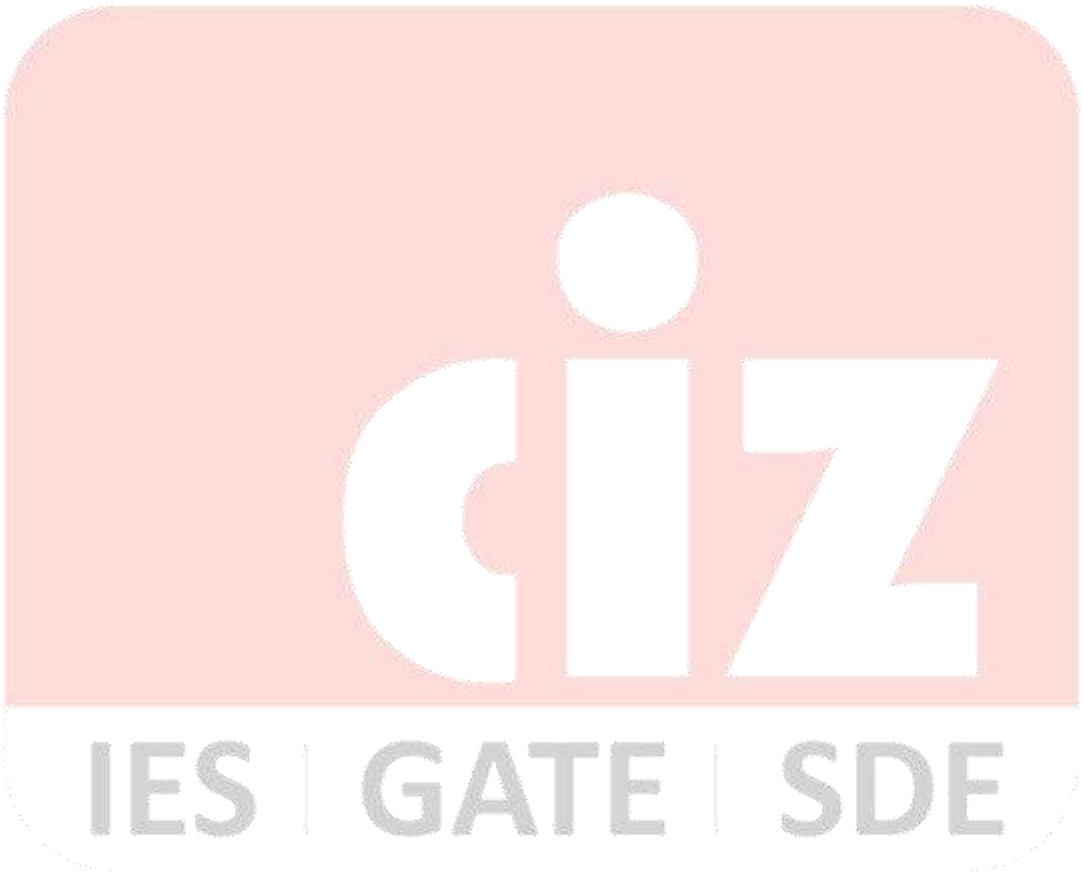
Mechanical Engineering (CE) – GATE Syllabus

S.NO.	SUBJECT NAME	SYLLABUS
1	**Engineering Mathematics**	**Linear Algebra:** Matrix algebra, Systems of linear equations, Eigen values and Eigen vectors. **Calculus:** Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems. **Differential Equations (DE):** First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations. **Complex Variables:** Analytic functions, Cauchy-Riemann equations, Cauchy's integral theorem and integral formula, Taylor and Laurent series. **Probability and Statistics:** Definitions of probability, sampling theorems, conditional probability, mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions. **Numerical Methods:** Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.
2	**Applied Mechanics and**	**Engineering Mechanics:** Free-body diagrams and equilibrium; trusses and

	Design	frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions. Mechanics of Materials, Stress and strain, elastic constants, Poisson's ratio, Mohr's circle for plane stress and plane strain; thin cylinders, shear force and bending moment diagrams, bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns, energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine, testing of hardness and impact strength. **Theory of Machines:** Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages, cams; gears and gear trains, flywheels and governors; balancing of reciprocating and rotating masses, gyroscope. **Vibrations:** Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts. **Machine Design:** Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints, shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.
3	**Fluid Mechanics and Thermal sciences**	**Fluid Mechanics:** Fluid properties, fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy, fluid acceleration, differential equations of continuity and momentum, Bernoulli's equation, dimensional analysis, viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings. **Heat- Transfer:** Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts, thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods, radiative heat transfer, Stefan Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis. **Thermodynamics:** Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases, zeroth and first laws of thermodynamics, calculation of work and heat in various processes, second law of thermodynamics, thermodynamic property charts and tables, availability and

		irreversibility, thermodynamic relations. **Applications:** Power Engineering, Air and gas compressors, vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning, Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychometric chart, basic psychometric processes. Turbo machinery, Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.
4	**Materials, Manufacturing and Industrial Engineering**	**Engineering Materials:** Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials. **Casting, Forming and Joining Processes:** Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes, load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding. **Machining and Machine Tool Operations:** Mechanics of machining, basic machine tools, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining, principles of non-traditional machining processes, principles of work holding, design of jigs and fixtures. **Metrology and Inspection:** Limits, fits and tolerances; linear and angular measurements; comparators; gauge design, interferometry, form and finish measurement, alignment and testing methods, tolerance analysis in manufacturing and assembly. **Computer Integrated manufacturing:** Basic concepts of CAD/CAM and their integration tools. **Production Planning and Control:** Forecasting models, aggregate production planning, scheduling, materials requirement planning. **Inventory Control:** Deterministic models, safety stock inventory control systems. **Operations Research:** Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.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