Name of Specialization: Machine Design	
No. of Question: 50 (Objective Type)	
Duration: 1 Hr. 30 Min	Maximum Marks: 50

Design of Machine Elements: Manufacturing Aspects in Design, Allowable stresses, factor of safety, Design of machine elements subjected to direct stress, pin, cotter and keyed joints, design of screw fastening. Design of Beams, levers and laminated springs. Design of shafts and shaft couplings. Design of brackets, screw fasteners subjected to eccentric loading.

Fatigue Considerations in Design, Design of machine members subjected to variable loading, Design for finite life. Pre-Loading of Bolts- Effect of initial tension and applied loads, Design of members which are curved like crane hook, body of C-clamp, machine frame etc., Design of power screws like lead screw, screw jack. Design of springs, Design of belt, rope and pulley drive system, selection of chain and sprocket drive systems. Design of gear teeth, Lewis and Buckingham equations, wear and dynamic load considerations, Design and force analysis of different type gears. Design of Sliding and Journal Bearing.

Theory of Machines: Kinematic and dynamic analysis of mechanisms. Cams. Belts and ropes. Chain drive. Friction. Screw jack, pivots, clutches, brakes. Dynamometers. Cams. Governors. Gyroscope. Balancing. Inertia force analysis. Flywheel. Gears. Gear Train.

Strength of Materials: Stress and strain in two dimensions, Principal stresses and strains, Mohr's construction, linear elastic materials, isotropy and anisotropy, stress-strain relations, uniaxial loading, thermal stresses. Beams: Bending moment and shear force diagram, bending stresses and deflection of beams. Shear stress distribution. Torsion of shafts, helical springs. Combined stresses, thick-and thin-walled pressure vessels. Struts and columns. Strain energy concepts and theories of failure. Timoshenko beam theory and Kirchoff's plate theory. Introduction to concepts of fracture mechanics. Numerical and Experimental methods, Introduction to Photo-elasticity and strain gauge techniques.

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Vibrations: Free and forced vibration of single degree of freedom systems; effect of damping; resonance, Vibration isolation and transmissibility. Two degrees of freedom system. Two degrees of freedom system. Critical speeds of shafts. Many degrees of freedom systems: exact analysis and approximate methods. Vibration of continuous systems: bars, beams, membranes and plates. Nonlinear

vibrations: Phase space, singular points, limit cycle; Analytical methods, perturbation techniques, equivalent linearization; Duffing's equation, jump phenomenon, Van der Pol's equation. Stability criterion.

Finite Element Methods: One- and two-dimensional finite element analysis. Method of weighted residuals and variational approach for solving differential equations. Galerkin and Rayleigh-Ritz methods. Finite element method and implementation. Convergence criterion. Finite element formulation for linear elastic continuum. Sub structuring. Introduction to dynamic problems.