Kadi Sarva Vishwavidyalaya, Gandhinagar

PART-1 (BASIC AWARENESS AND APTITUDE ON RESEARCH) – 50 Marks

PART-2 Syllabus for Ph.D Entrance Test: Mechanical Engg. (Marks-50)

Section 1: Applied Mechanics and Design

1) **Engineering Mechanics:** Free-body diagrams and equilibrium; trusses and 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.

2) **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.

3) **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.

4) **Vibrations:** Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

5) **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.

Section 2: Fluid Mechanics and Thermal Sciences

6) **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.

7) **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.

8) **Thermodynamics:** Thermodynamic systems and processes; properties of pure substances, behaviour 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.

9) **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, psychrometric chart, basic psychrometric processes. Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Section 3: Materials, Manufacturing and Industrial Engineering

10) **Engineering Materials**: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

11) **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.

12) **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.

13) **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.

14) **Computer Integrated Manufacturing:** Basic concepts of CAD/CAM and their integration tools.

15) **Production Planning and Control:** Forecasting models, aggregate production planning, scheduling, materials requirement planning.

16) **Inventory Control:** Deterministic models; safety stock inventory control systems.

17) Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

References:

1) Engineering mechanics, D.P.Sharma, Pearsen Publications.
2) Strength of Materials(Mechanics of Materials), R.K.Rajput
3) Theory of machine , S.S.Rattan
4) S.S.Rao, Mechanical Vibrations, Pearson Publications.
5) Machine design, V.B.Bhandari, Tata McGraw-Hill Education.
6) Fluid Mechanics, R.K.Bansal.
7) Heat transfer, D.S.Kumar, S.k.Kataria & sons.
8) Thermodynamics, P.K.Nag, Tata McGraw-Hill Education.
9) Applications (Basic mechanical engineering), Pravin kumar, Pearson Publications.
10) Material science and Engineering an introduction,William D Callister, wiley Publications.
11) Manufacturing technology Vol.1, P.N.Rao, Tata McGraw-Hill Education.
12) Manufacturing process, J.P.Kaushis, P.H.I Publication.
13) Engineering Metrology, R.K.Jain,
14) CAD/CAM, ibrahim zeid.
15) Industrial engineering and management, R.K.Jain.