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**Uttar Pradesh Public  
Service Commission  
(UPPCS Mains)**

**Exam Syllabus**

**Optional Subjects**  
**Mechanical Engineering**

# PAPER - I

## (PART-A)

- 1. Theory of Mechines:** Kinematic and dynamic anyalysis of planer mechanisms, belt and chain drives, gears and gear train, cams, flywheel and governors. Balancing of rotating and reciprocating masses, single and multi cylinder Engines.
- 2. Mechanical Vibrations:** Vibrating systems, single degree freedom systems, natural frequency, damped and forced vibrations, resonance, force transmissibility, two degree of freedom systems, vibration absorbers, whirling of shafts and critical speeds.
- 3. Mechanics of Solids:** Stress and strain, elastic constants, uniaxial loading, therma stress, two dimensional stress analysis, principal stresses, generalised Hook's law, total and distorsion strain energy, theories of failures, bending and shear stresses in beams, Torsion of shafts, Close coiled Helical springs, Thin and thick pressure versels, rotating discs, Buckling of columns.
- 4. Engineering Materials:** Basic concept of structure of solids, crystalline materials, crystal defects, alloys and binary phase diagrams, structures and properties of common engineering materials. Basics of polymers, ceramics and composite materials; IronCarbon equilibrium diagram, heat treatment of steels.

## (PART-B)

- 5. Manufacturing Science:** Machine tool Engineering, Merchant's force analysis, Taylor's tool life equation, conventional machining, NC and CNC machining Processes, jigs and fixtures, standard forming and welding processes.
- 6. Non Convensional Machining Processes:** EDM, ECM, Ultrasonic machining, water jet machining etc, application of lasers and plasmas, energy rate calculations. Metrology: concept of fits and tolerances, tools and gauges, comparators, inspection of length, position, profile and surface finish.
- 7. Manufacturing Management:** Product development, value analysis, Break-even analysis, forecasting techniques, Operation Scheduling, Capacity Planning, Assembly line balancing, CPM and PERT, Inventory control, ABC Analysis, EOQ model, material requirement planning, job design, job standards, method study and work measurements.
- 8. Quality Management:** Quality analysis, control charts, acceptance, sampling, total quality management, Operations research, linear programming, graphical and simplex methods, Transportation and assignment models, single Serve queueing model, Value Engineering.

# PAPER - II

## (PART-A)

- 1. Thermodynamics:** Laws of thermodynamics and their applications; T-ds equations Maxwell and Clapeyron equation and their uses; Availability and irreversibility
- 2. Fluid Mechanics:** Properties and classification of fluids, Manometry, forces on immersed surfaces, stability of floating bodies, Kinematics and dynamics of incompressible fluids. Laminar and turbulent boundary layer flows. Bernoulli's equation, fully developed flow through pipes.
- 3. Heat Transfer:** Modes of heat transfer, One dimensional steady and unsteady conduction. Heat transfer through extended surfaces. Free and forced convective heat transfer, Empirical correlations in laminar and turbulent flows, Heat Exchangers, Radiation heat transfer laws, shape factor, heat exchange between black and gray surfaces.
- 4. Refrigeration and Air Conditioning:** Vapour compression, vapour absorption, steam jet and air refrigeration systems, Desirable properties of refrigerants, eco- friendly refrigerants, Analysis of compressors, condensers, expansion valves and evaporators.

## (PART- B)

- 5. I.C Engines:** Classification, Thermodynamic cycles of operation, Performance Calculations, Heat balance sheet, Combustion in S.I and C.I Engines, normal and abnormal combustion, knocking and detonation. Effect of variables on knocking and detonation, Fuels used in S.I and C.I Engines, Fuel injection, carburetion and multi point fuels injection (MPFI) Supercharging, Engine cooling, Emission and Control, Turboprop and Rocket Engines.
- 6. Steam Engineering:** Modern steam Generators, Rankine cycle, Modified Rankine cycle and analysis, Natural and artificial draught, flow of steam in convergent and divergent nozzles, pressure at throat for maximum discharge, super saturated flow in nozzles, Wilson line.
- 7. Turbomachines:** Classification, Continuity, momentum and energy equations, Flow analysis in axial and centrifugal compressors and turbines, Dimensional analysis and modelling. Performance of Pumps, Compressors and turbines.
- 8. Power Plant Engineering:** Site selection for Steam, Hydro Nuclear and Gas Power Plants, dust removal equipments, fuel handling and cooling water system. Thermodynamic analysis of steam and gas turbine power plants, governing of turbines. Solar, Wind and Nuclear Power Plants, Economic power generation.