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Mechanical Engineering Syllabus for Uttarakhand State Civil Services Preliminary Exam-2011

MECHANICAL ENGINEERING

PART 'A'

1. **Statics:** Simple applications of equilibrium equations. Friction. Trusses, Principle of virtual work.
2. **Dynamics:** Simple application of equations of motion. Work, energy and power. Impulse and momentum.
3. **Theory of Machines:** Simple example of kinematic chains and their inversion. Belts friction, wheels, gears and bearings. Governors-centrifugal and spring-loaded. Flywheels, Cams. Balancing of rigid rotors. Simple vibration analysis of bars and shafts. Brakes and dynamometers.
4. **Mechanics of Solids:** Stress-strain concepts. Stress-strain relationship. Mechanical properties and testing. Shear and bending moments in beams. Simple bending and torsion concepts. Mechanical springs. Thin walled cylinders. Elastic stability of columns.
5. **Fluid Mechanics:** Hydrostatics, Continuity equation. Euler's and Bernoulli equation. Flow through pipes. Boundary layers over flat plate and tubes. Dimensional analysis.

PART 'B'

6. **Manufacturing Science:** Manufacturing processes. Mechanics of metal cutting. Tool life equation. Cutting tool materials. Machinability. Economics of machining. Basic types of machine tools and their processes. Automatic machine tools. Numerical control. Unconventional machining processes. Metal forming processes & machines. Types of casting and welding methods. Power metallurgy. Processing of polymers. Jigs & fixtures, Heat-treatment of metals & alloys, Fe-Cequilibrium diagram, T-T-T diagram.
7. **Manufacturing Management:** Location and layout of plants. Material handling jobs Shop and mass production. Production planning and control-scheduling, dispatching, routing and expediting. Inventory control-ABC analysis. Economic order quantity. Material requirement planning. Statistical quality control-control charts. Acceptance sampling. Cost estimation and break even analysis. Linear programming-graphical and simplex methods. Work simplification. Work space design. Product development. Value analysis. Job enlargement. Job enrichment. Time study & Method study, CPM & PERT
8. **Thermodynamics:** Basic concepts-system and processes, heat and work. Zeroth law of thermodynamics. Ideal and real gases-equation of state for ideal gases. Compressibility factor-Van-der Walls equation of state. Behaviour of pure substances-properties and property diagrams. First law of thermodynamic and its applications. Second law of thermodynamics, its corollaries and applications. Gas power cycles-Carnot, Otto, Diesel, Dual and Brayton cycles. Open and closed cycle gas turbines. Vapour power cycles-Rankine reheat and regenerative. Refrigeration cycles-Bell-Collemn, vapour-compression and vapour-absorption cycles steam turbines condensers.
9. **Energy Conversion:** Layout of thermal power plants. Steam and gas nozzles-classifications energy equation and critical pressure. Steam generators-high pressure boilers such as La-Mont, Velox and Radiant: mountings and accessories. Steam turbines-impulse and reaction, velocity diagrams. Surface condensers-construction and working principles. Layout of hydraulic power plants. Hydraulic turbines and pumps-Construction and working principles, Specific speed. Layout of nuclear power plants-nuclear reactors, nuclear fission, construction detailed and working principle.
10. **Refrigeration & Air-Conditioning:** Layout of vapour-compression and absorption refrigeration systems. Refrigerants and their properties. Operation and maintenance. Air-conditioning-psychrometric chart, comfort zones. Psychrometric processes-sensible heating and cooling, humidification and dehumidification. Types of cooling loads.