Download Bihar Public Service Commission (BPSC Mains)

Optional Subject -

Mechanical Engineering

MECHANICAL ENGINEERING

Section- I

Statics – Equalibrium in three dimension suspension cables, principle of virtual work.

Dynamics – Relative motion coriolis force motion, of a rigid body. Gyrsocpic motion impulse.

Theory of Machines – Higher and lower pairs, inversions, sterign mechanisms. Hooks joint velocity and acceleration of links, interia forces. Cama conjugate action of gearing and interference, gear trains epicyclic gears. Clutches, belt drives, brakes dynamometers, flywheels governors. Balancing of rotating and reciprocating masses and multicylinder engines. Free, forced and damped vibrations for a single degree of freedom. Degrees of freedom critical speed and whirling of shafts.

Mechanics of solids – Stress and strain in two dimension. Mohr's circle. Theories of failure, deflection of beams. Buckling of columns, combined binding and torsion castiglapo's theorem. Thick cylinders rotating disks Shrink fit. Thermal stresses.

Manufacturing Science – Merchant's theory Taylors equation. Machineability. Unconventional machining methods including EDM, ECM and ultrasonic machining. Use of lesers and plasms. Analysis of forming processes high velocity forming expolsive forming. Surface roughness, gauging comparators, Jigs and Fixtures.

Production Management- Work simplification work sampling value engineering. Line balancing, work station design, storage space requirement. A B C analysis. Economic order, quanitity including finite production rate. Graphical and simplex methods for linear programming; transportation model, elementary quieing theory. Quality control and its uses in product design. Use of X, R, P (Sigma) and C charts. Single sampling plans, operating characteristic curves, average sample sçe Regression analysis.

Section- II

Thermodynamics – Applications of the first and second laws of thermodynamics. Detailed analysis of thermodynamics cycles.

Fluid Machanies – Continuity, momentum and energy equations. Velocity distribution in laminar and turbulent flow. Dimensional analysis. Boundary layer on a flat plate. A diabatic and isentrophic flow. Mach number.

Heat Transfer – Critical thickness of insulation conduction in the presence of heat sources and sinks. Heat transfer from fines. One dimensional unstuady conducation. Time constant for the mocouples. Momentum and energy equations for boundary layers on a flat plate. Dimensionless number free and forced convection. Boiling and condensation nature of radiant heat. Stefan-Boltz-Mann Law. Configuration factor logarithmic mena temperature difference. Heat exchanger effectivencess and number of transfer units.

Energy Conversion – Combustion phenomenon in C.I and S.I engines carburation and fuel injection Selection of pumbs classification of hydraulic turbines, specific speed. performace of compressor. Analysis of steam and gas turbines. High pressure boilers, Unconventional power systems, including Nuclear power and M H D systems. Utilisation of solar energy.

Environmental Control – Vapour compression absorption, steam jet and air refrigeration systems, properties and characteristics of important refregerants. Use of phychometric chart and comfort chart, estimation of cooling and haring loads. Calculation of supply air state and rate. Air conditioning plants lay-out.