HEAT-TRANSFER: Modes of heat transfer; one dimensional steady heat conduction through plane wall, cylinder and sphere, composite systems, resistanceconcept and electrical analogy, heat transfer through fins, unsteady heatconduction, lumped parameter system, Biot and Fourier number,Thermal boundary layer,dimensionless parameters in free and forced convective heat transfer, heat transfercorrelations for flow over flat plates and through pipes, effect of turbulence; convection with phase change, condensation and boiling,heatexchanger classification and performance, LMTD and NTU methods; Radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors,radiation network analysis. Mass transfer in laminar and turbulent convection.

SECTION – III (Marks – 20)

THERMODYNAMICS: Thermodynamic systems and processes; properties of puresubstances, behavior of ideal and real gases, zeroth and first laws ofthermodynamics, calculation of work and heat in various processes; second law ofthermodynamics; carnot cycle, thermodynamic property charts and tables, availability andirreversibility; thermodynamic relations. Thermodynamics of combustion,complete and incomplete combustion analysis, analysis of products of combustion, Orsat apparatus.

APPLIED THERMODYNAMICS: *Reciprocating and rotary compressors*; vapour and gas powercycles, concepts of regeneration and reheat. Gas Turbine cycles with multistage compressions, Reheating, regeneration and intercooling, Jet Propulsion: Turboprop and turbojet-engines.

Gas dynamics: isentropic flow through converging and converging diverging nozzles, effect of friction on nozzle performance, Normal shock,Fanno line and Rayleigh line.

Steam Nozzle and turbines: Steam flow through nozzles, type of nozzles, critical pressure,Steam turbines,types and classification. Impulse and reaction turbine, methods of reducingrotor speed, principles of governing speed,Condensers: Types–Description.

I.C. Engines: Air-standard Otto, Dieseland dual cycles, performance and testing, Morse test and Willian's line, Detonation and knocking phenomenon. Vehicular emission norms and its control.

Refrigeration and air-conditioning: Air refrigeration systems, Vapourcompression and absorption systems, cascade system, water refrigeration, thermoelectric refrigeration, cryogenics, refrigeration equipments, properties of moist air, psychrometric chart, basicpsychrometric processes, psychrometry of air conditioning processes, introduction to comfort air conditioning, effective temperature and comfort charts.
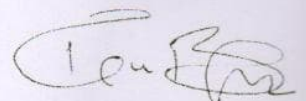
Turbomachinery: Impulse and reaction principles, velocitydiagrams, Pelton-wheel, Francis and Kaplan turbines, Draft tube, cavitation, centrifugal pump and its characteristics.

*Measurement:*Temperature measurement using thermocouples, RTD and thermistors.

SECTION – IV (Marks – 30)

PRODUCTION ENGINEERING: Principle of working and equipments for welding processes. Foundry and casting processes. Hot & cold rolling, forging, drawing and extrusion process: design & analysis. Metal forming. Theories of metal cutting : orthogonal and oblique. Tool Life & tool wear, Unconventional machining methods. Jigs and fixtures, NC, CNC and DNC machines. Limits, fits and tolerances. Statistical quality control: Control charts and sampling plans.

INDUSTRIAL ENGINEERING: Types of organizations, Principles and function of management, Scientific management. Production planning and control. Method study & Work measurement. Break even analysis and inventory control. CPM and PERT. Job evaluation and merit rating. Wage payment systems and incentive schemes. Industrial occupational health & safety and related acts. Factory and boiler act. Labour acts. Plant Layout & Location and Material Handling: principles, tools & techniques. Linear, Integer, Dynamic and non-linear programming, Assignment and transportation models, Queuing Models.

Prof. Rajat Bhagwat
Convener

Technology
68. Production Management
69. Production System
70. Production Technology & Management
71. Robotics & Mechatronics
72. Thermal & Fluid Engineering
73. Thermal Engineering
74. Thermal Power Engineering
75. Thermal Science
76. Thermal Science Engineering
77. Thermal System & Design
78. Tool Design
79. Tribology & Maintenance Engg.
80. Turbo machinery
81. Computer Aided Design & Manufacture
82. Design & Production Engineering.

(Annexure 'B')

SYLLABUS OF THE WRITTEN TEST
FOR
THE POST OF ASSISTANT PROFESSOR IN MECHANICAL ENGINEERING
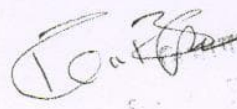(Approved by Departmental Council)

SECTION – I (Marks – 30)
STRENGTH OF MATERIALS: Stress and strain, Thermal stresses, Elastic constants, Hoop stress in thin cylindrical and spherical vessels subjected to internal pressure, Shear force and bending moment diagrams, Principal planes and stresses, Mohr's circle, Theories of failures, Shear and bending stresses, Deflection of beams, Torsion of shafts, Columns and struts, Strain Energy.

DESIGN OF MACHINE ELEMENTS: Engineering materials and their properties, Heat treatment, Factor of safety, Stress concentration, Fatigue failure. Design of machine elements such as Cotter and Knuckle joints, Bolts, Riveted joints, welded joints, shafts, keys, couplings and gears. Rope and Chain drives, flat and V-belt drives, Design of journal bearings, selection of antifriction bearings. Design of thick and thin cylinders. Springs and levers. Design of Eccentrically Loaded Components and Joints. Design of Curved Beams and Crane hook. . Design of Screw motion mechanism: Screw jack, Togle jack, Lead screw, screw press etc. Design of clutches and brakes. Design of components subjected to high temperature and pressure : I.C. Engine piston, cylinder and cylinder head, Crank shaft and connecting rod. Pressure vessels: Fatigue and creep considerations.

THEORY OF MACHINES: Kinematics Links, pairs, chains and mechanisms. Inversions of four bar, single and double slider crank chains. Coefficient of Fluctuation of speed and energy, Weight of flywheel. Flywheel applications, Straight line and steering gear mechanisms, Gear and gear trains. Belt, rope and chain drive. Clutches and brakes. Cams and followers. Flywheel and Governors. Gyroscope. Balancing of rotating and reciprocating masses. Free and forced vibrations of single degree of freedom systems. Critical speed of shafts. Torsional vibration : analysis up to three rotors system, geared system Multi – dof – system

SECTION – II (Marks – 20)
FLUID MECHANICS: Fluid properties, Newtonian and non-Newtonian fluids, fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies and metacentric height, control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; application of Bernoulli equation in flow measurement, dimensional analysis; viscous flow of incompressible fluids, Hagen poiseullie and Couette flow, boundary layer flow, laminar and turbulent boundary layer, Integral momentum equation. Flow through pipes, major and minor losses in pipes, Hydraulic gradient and total energy line. Forces on immersed bodies, lift and drag force, streamlined and bluff bodies, Flow around sphere, Stokes law, Flow around aerofoil.