

IV Semester

THERMOFLUID ENGINEERING

M 251

UNIT – I

Concept of continuum, types of fluids and their properties, Kinematics of fluid flow: Lagrangian & Eulerian Method, Description of Fluid Flow, Stream Line, Path line and Streak Line, Types of Flow and Types of motion, local and convective acceleration, Integral forms of Continuity equation, Momentum equation and Energy equations, simple problems on all topics.

UNIT - II

Gas Dynamics: (a) Continuity, momentum and energy equations for one-dimensional, steady and compressible flows, review of thermodynamical concepts stagnation and critical properties.

(b) Isentropic flow: sonic velocity, Mach number, Mach angle, propagation of sound wave, isentropic flow through nozzles; choking, effect of friction, under design and off design conditions, effect of area variation on isentropic flow; relationship between pressure drop, area and Mach number and simple problems.

UNIT - III

(a) Normal shock; governing equations, analysis of normal shock, Rankine-Hugoniot relation, Prandtl relation, Propagation of Shock Wave, Converging and Diverging Nozzles with normal Shock Waves, numerical problems.

(b) Flow through ducts of constant area: governing equations; adiabatic flow (Fanno-line), frictionless flow with heat transfer (Rayleigh line), numerical problems.

UNIT - IV

Laminar flow through pipes, viscous flow between parallel plates, shear stress distribution in a fully developed pipe flow, loss of head due to friction; Darcy resistance equation, major and minor losses, pipes in series & parallel and simple problems.

Boundary Layer Theory: Physical Concept of Laminar and Turbulent boundary layer, Force on immersed bodies: Lift and Drag, simple problems.

UNIT – V

Hydraulic Turbines : Classification of turbines and their constructional details, fundamental equation for power developed and efficiency, performance characteristics, unit quantities, specific speed, governing of turbines , cavitation and simple problems on various topics.

List of Books:

1. Thermal Engineering R.K. Rajput
2. Thermal Power Engineering R. Yadav
3. Thermal Engineering Domkundwar
4. Fluid Mechanics and Hydraulic machines. R.K. Bansal
5. Turbo Machines A Valan Arasu

MACHINE DESIGN -I

M 252

UNIT –I

Design of fasteners: Knuckle, cotter, threaded joint, design and drawing of permanent fasteners - riveted joints, welded joints, eccentric loading of riveted joints, welded and bolted joints, and computer aided design of at least one joint

UNIT - II

Concepts of creep and fatigue, design of shaft design for power transmission including combined bending and torsion and design of shaft couplings, effects of stress concentration, computer aided design of at least one coupling.

UNIT- III

Spring design: Helical springs, closed and open coiled tension, compression springs and their ends, design of leaf springs, power screws - designing for various types of screw jacks, lead screw of lathe machine, and screw press.

UNIT- IV

Design methods, preliminary design, conceptual design, detailed design, and design for manufacture, assembly environment, maintenance, reliability, concurrent engineering, reverse engineering, and creative design.

UNIT- V

Hydraulic presses and pneumatic presses.

Books & References

1. Mechanical Engineering Design J.E. Shigley and Charles R.Mischke, TMH
 2. Engineering Design G.E. Dieter
 3. Mechanics of Solids, Vol. 2 E.J.Hearn
 4. Machine Design Kulkarni, TMH
 5. Handbook of Mechanical Design G.M.Maitra and L.V. Prasad, TMH
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MANUFACTURING PROCESS – I

M 253

UNIT – I

Lathe: Turning and related operations, geometry of a single point cutting tools, speed, feed and depth of cut, classification of lathes, lathe mechanisms, lathe centres, mandrells, chucks, collects, face plates, steady and follow rests, tool holders their study and use. Lathe Operations, lathe attachments, taper turning, thread cutting and their calculations, lathe specifications. Introduction to CNC lathes.

UNIT –II

Drilling: Geometry of twist drills, drill chucks, feeds in drilling, machine types and specifications, boring, reaming, spot facing, counter sinking and counter boring.

Shaping: Shaping and planing processes, type of shapers and their mechanism, types of planers, and their mechanism, principal tools, specifications of shaper and planer. Introduction CNC Drilling. Single & Multispindle)

UNIT –III

Foundry: Moulding sand testing, moulding methods and machines, casting processes, gray Cast Iron, white cast iron and malleable Cast Iron. Iron castings.

Melting furnaces : Cupola and electric furnaces, oil fired, air furnaces, cupola design and operation, design of casting, casting solidification, casting defects & remedies, gates, runners & risers.

UNIT –IV

Welding: Resistance welding, weldability of metals, submerged, electroslag, inert gas (TIG, MIG and CO₂) carbon arc welding, cold welding, thermite welding, friction welding, plasma arc welding, electron beam welding, laser beam welding, pre-heating, post heating and stress relieving, welding defects and remedies, brazing and soldering, welding symbols, welding consumables, classification, use and specifications.

UNIT – V

Cold working of metals: Press working equipment and operations, cutting action in a die, clearance, classifications, shearing, drawing, spinning, stretch forming, wire drawing, embossing, squeezing, swaging, coining and bending operations, calculation of press capacity. Quality assessment.

Books and References:

1. Workshop Technology I & II by Hazra Chowdhary
2. Workshop Technology I & II by Raghuwanshi

DYNAMICS OF MACHINES

M 254

UNIT –I

Flywheel and Governors: fluctuation of energy and speed, design of flywheel ,force analysis of governors, controlling force curves,sensitivity,stability,effort,power of governor.

UNIT - II

Friction devices: power screw, plate, cone and centrifugal clutches, band and block brakes.Dynamometer –Absorption and transmission types. Transmission of power by belts, ropes and chains.Gear trains.

UNIT- III

Force Analysis of Machines: Concept of free body and its equilibrium.D'Alembert principle dynamic force analysis.

Dynamics of Reciprocating Machines: Equivalent dynamical systems, inertia forces, bearing loads, crank shaft torque delivered, forces on connecting rod, forces on crank shaft.

Cam dynamics: Force Analysis of Cam follower systems, follower response, jumps and cross over shock, zonson numerical analysis, unbalance spring surge and wind up.

UNIT- IV

Vibration (longitudinal & transverse): Free, damped and forced vibrations of single degree of freedom for a mechanical system, transverse vibration of loaded and unloaded shafts, transverse vibration of shafts having several loads , critical speed for whirling of shafts.

Vibration (torsional): Torsional Vibrations of geared system ,torsional vibrations of two and three rotor systems, vibration transmission and isolation ,vibrations in two degrees of freedom for a mechanical system.

UNIT-V

Balancing: Balancing of rotating masses in one plane and in different parallel planes, balancing of four bar linkages including slider crank mechanism, balancing of radial engines, including V, In line and locomotive engines, principal of balancing machines.

Books & References

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| 1. | Theory of mechanism & machines | J.E. Shigley and Uicker |
| 2. | Mechanical Vibration | W.T. Thomson |
| 3. | Theory of machines | Rattan |
| 4. | Mechanics of Machines | V.Ramamurti |
| 5. | Design of Machinery | Norton |
| 6. | Mechanical Vibrations | G.K.Grover |
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DYNAMICS OF MACHINE LAB.

M 292

S. No.	Name of Experiment
1.	Balancing of Rotor on the Dynamic Balancing Machine.
2.	To find the Speed at which jump Phenomenon occurs in the CAM follower Systems.
3.	To verify the Formula for Gyroscopic Couple.
4.	To obtain the controlling force curves in watt, Porter, Proell and Hartnell Governors.
5.	Plot of Longitudinal and Transverse oil Pressure Developments in the Mitchell Tilting Pad Apparatus.
6.	Plot of Radial Pressure Distribution and evaluation of load carrying capacity of the Journal Bearing.
7.	To find the Torsional frequency of Vibrations (Undamped and Damped) of single and two rotor systems.
8.	To find Frequency of vibrations of a damped force Vibrating Systems.
9.	To find Natural Frequency of Vibration of Compound and Torsional Pendulums (Biflar and Trifilar Suspensions).
10.	To obtain the Static and Dynamic Balancing on the Experimental Apparatus.
11.	To Determine whirling speed of the shaft on the whirling apparatus & to verify the Dunkerley's formula on it.
12.	Study of Dynamic – Vibration Absorber and Determination of spring stiffness and mass of the absorber.
13.	Sound and Vibration Measurements by Precision Sound Level Meter.

General Proficiency : M 299