B. Tech (Mechanical Engineering)

SEMESTER –V

Sl No.	Course Code	Course Title	Hours Per Week			Total Credits
			Lecture	Tutorial	Practical	
1.	102501	Fluid Machinery	3	0	0	3
2.	102502	Heat Transfer	3	0	0	3
3.	102503	Kinematics of Machine	3	1	0	4
4.	102504	Manufacturing Processes	3	0	0	3
5.	100510P	Summer Entrepreneurship-II	-	-	-	6
6.	100511P	Open Elective-I (NPTEL Courses-2)	0	0	4	2
7.	102501P	Fluid Machinery Lab	0	0	3	1.5
8.	102502P	Heat Transfer Lab	0	0	3	1.5
9.	102504P	Manufacturing Processes Lab	0	0	3	1.5
TOTAL						25.5

SEMESTER –V

Course Code- 102501 Fluid Machinery 3 0 0 3

Unit- 1.0: **7 hrs**

Introduction – Classification of fluid machinery.

Unit- 2.0: **7 hrs**

Dynamic action of fluid jet – Impact of fluid jet on fixed and moving flat places, impact of jet on fixed and moving curved vanes, flow over radial vanes, jet propulsions.

Unit- 3.0: **7 hrs**

Euler's fundamental equation, degree of reaction.

Unit- 4.0 : **7 hrs**

Hydraulic turbines, introduction, classification, impulse turbine, construction details, velocity triangles, power and efficiency calculations, reaction turbines; constructional details, working principle, velocity triangles, power and efficiency calculations, draft tube, cavitation, governing.

Unit-5.0: **7 hrs**

Principle of similarity in fluid machinery; unit and specific quantities, testing models and selection of hydraulic turbines. Positive displacement pumps: Reciprocating pump; working principle, classification, slip, indicator diagram, effect of friction and acceleration, theory of air vessel, performance characteristics gas gear oil pump and screw pump.

Unit- 6.0: **7 hrs**

Rotodynamic pumps: Introduction, classification, centrifugal pump; main components, working principle velocity triangle, effect of shape of blade specific speed, heats, power and efficiency, calculations minimum steering speed, multi stage pumps, performance characteristic, comparison with reciprocating pump.

Text/ Reference:-

1. G. T. Mase, R. E. Smelser and G. E. Mase, Continuum Mechanics for Engineers, Third Edition, CRC Press,2004.
2. Y. C. Fung, Foundations of Solid Mechanics, Prentice Hall International, 1965.
3. Lawrence. E. Malvern, Introduction to Mechanics of a Continuous Medium, Prentice Hall international, 1969.
4. Hydrantic Machine by Jagdish Lal.
5. Hydraulics & Hydraulic Machines by Vasandari.
6. Hydrantic Machine by RD Purohit.

Course Code- 102502 Heat Transfer 3 0 0 3

Unit 1.0- **9 hrs**

Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.

Unit 2.0- **9 hrs**

Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.

Unit 3.0 – **8 hrs**

Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.

Unit 4.0- **7 hrs**

Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and ε-NTU method.

Unit 5.0 – **5 hrs**

Boiling and Condensation heat transfer, Pool boiling curve.

Unit 6.0- **4 hrs**

Introduction mass transfer, Similarity between heat and mass transfer.

Text/ Reference:-

1. Bejan, Heat Transfer John Wiley, 1993
2. J.P. Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
3. F.P. Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007.
4. Massoud Kaviany, Principles of Heat Transfer, John Wiley, 2002.
5. Yunus A Cengel, Heat Transfer: A Practical Approach, McGraw Hill, 2002.

Course Code-102503 Kinematics of Machine 3 1 0 4

Unit- 1.0: **7hrs**

Introduction: Classification of mechanisms: -Basic kinematic concepts and Definitions Degree of freedom, mobility-Grashof's law, Kinematic inversions of four bar chain and slider crank chains.

Unit- 2.0 **7hrs**

Kinematic analysis of plane mechanism: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, kinematic analysis of simple mechanisms- slider crank mechanism dynamics- Coriolis component of acceleration.

Unit- 3.0 **7hrs**

Friction devices: Belt drive, Clutch, Shoe brakes, Band and block brakes.

Unit- 4.0 **7hrs**

Gear: gear terminology, Involute and Cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting. **Gear Train:** Analysis of simple, compound, reverted and epicyclic gear train with problems.

Unit- 5.0 **7hrs**

Balancing of rotating masses: Balancing of rotating masses in the same plane by a single revolving mass. Balancing of several rotating masses in the same plane. Balancing of several rotating masses in different planes by two revolving masses in suitable planes.

Unit- 6.0 **7hrs**

Governors: Watt, Porter, Proel & Hartnell Governors, Effect of friction, controlling force, governor effort and power, sensitivity and isochronisms.

Text/ Reference:-

1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
2. CleghornW.L. , Mechanisms of Machines, Oxford University Press, 2005.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi, 1988.

Course Code- 102504 Manufacturing Processes 3 0 0 3

Unit-1.0: **7 hrs**

Conventional Manufacturing processes: Casting and Moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.

Unit-2.0: **7 hrs**

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming(forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

Unit-3.0: **7 hrs**

Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Unit-4.0: **7 hrs**

Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding. Additive manufacturing: Rapid prototyping and rapid tooling.

Unit-5.0: **7 hrs**

Machine Tools:

(a) Lathe: Principle, types, operations, turret/capstan, semi/automatic, Tool layout.

(b) Shaper, slotted, planer, operation, drive.

Unit-6.0: **7 hrs**

(c) Milling, Milling cutter, up & down milling, dividing head indexing, Max chip thickness, power required.

(d) Drilling and boring, reaming tools, Geometry of twist drill, Grinding, Grinding wheel, Abrasive, cutting action, grinding wheel specification, Grinding wheel wear, alterations, wear, fracture wear, dressing and trimming. Max chip thickness and guest criteria, Flat and cylindrical grinding, Centerless grinding, Super finishing, Honing lapping, Polishing.

Text/ Reference:-

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. Degarmo, Black &Kohser, Materials and Processes in Manufacturing.

Course Code-102501P Fluid Machinery Lab 0 0 3 1.5

Perform all Experiments

1. Performance on hydraulic turbines:
   a. Pelton wheel
   b. Francis turbine
   c. Kaplan turbine.
2. Performance on hydraulic pumps:
   a. Single stage and multi stage centrifugal pumps
   b. Reciprocating pump.
3. Performance test of a two stage reciprocating air compressor
4. Performance test on an air blower.

Course Code-102502P Heat Transfer Lab 0 0 3 1.5

Perform all Experiments

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
4. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length
5. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
6. Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.
7. Determination of Emissivity of a Surface.
8. Determination of Stefan Boltzmann's Constant.
9. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.

Course Code-102504P Manufacturing Processes Lab 0 0 3 1.5

Perform any 2 Experiment from Lab 1 & 2 and any 4 Experiments from Lab 4 (All Experiments from Lab 3).

1. Metal Casting Lab:

a. Pattern Design and making – for one casting drawing.
b. Sand properties testing (strengths and permeability)
c. Moulding, Melting and Casting

2. Welding Lab:

a. ARC Welding Lap & Butt Joint.
b. b.Spot Welding.
c. c.Gas Welding

3. Mechanical Press Working:

a. Blanking & Piercing operation and study of simple, compound and progressive press tool.
b.Bending and other operations

4. Machining Lab:

a. Cutting operation (Orthogonal & Oblique) on lathe machine
b. Bolt making on lathe machine
c. Facing, plain turning and step turning knurling
d. Boring and internal thread cutting.
e. Finishing of a surface on surface –grinding machine
f. Gear cutting on milling machine (Spur Gear).
g. Machining a block on shaper machine.
h. Drilling holes on drilling machine.