Manufacturing Processes

PCC-ME 303 Manufacturing Processes

4.5 Credits

Module: 1
Conventional Manufacturing processes: Casting and Moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.

Module: 2
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.

Module: 3
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.

Module: 4
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

Module:5
Machine Tools:
(a) Lathe: Principle, types, operations, turret/capstan, semi/automatic, Tool layout.

(b) Shaper, slotted, planer, operation, drive.
(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, Fla and cylindrical grinding, Centerless grinding, Superfinishing, Honing lapping, Polishing

Text Books:
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

Fluid Machinery

PCC-ME 302 Fluid Machinery

4.5 Credits

Module: 1
Introduction – Classification of fluid machinery.

Module: 2
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.

Module: 3
Euler's fundamental equation, degree of reaction.

Module: 4
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.

Module: 5
Principle of similarity in fluid machinery; unit and specific quantities,

testing models and selection of hydraulic turbines.

Module: 6
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.

Module: 7
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 Books:
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

Heat Transfer

PCC-ME 301Heat Transfer

4.5 Credits

Module: 1
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.

Module:2

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.

Module: 3
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.

Module: 4
Types of heat exchangers, Analysis and design of heat exchangers using bothLMTD and ε-NTU methods.

Module: 5

Boiling and Condensation heat transfer, Pool boiling curve.

Module: 6
Introduction mass transfer, Similarity between heat and mass transfer

Text Books:
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. MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002
5. Yunus A Cengel, Heat Transfer: A Practical Approach, McGraw Hill, 2002

Kinematics of Machine

PCC-ME 304 Kinematics of Machine

4 credits

Module 1

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.

Module 2
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.

Module 3
Friction devices: Belt drive, Clutch, Shoe brakes, Band and block brakes.

Module 4
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.

Module 5
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.

Module 6
Governors: Watt, Porter, Proel & Hartnell Governors, Effect of friction, controlling force, governor effort and power, sensitivity and isochronisms.

Text Books:
[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.

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