

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Heat & Mass Transfer	ME 301	SM+MT+ET 25+25+50
Semester	Credits	L-T-P	Exam.
V	4	3-1-0	3 Hours

Unit - I

Introduction to Heat Transfer: Concepts of the mechanisms of heat flows; Conduction; Convection and radiation; Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism; One-dimensional general differential heat conduction equation in the rectangular; Cylindrical and spherical coordinate systems; Initial and boundary conditions. **(08 Hours)**

Unit - II

Conduction: Steady State one-dimensional Heat conduction; Composite systems in rectangular; Cylindrical and spherical coordinates with and without energy generation; Thermal resistance concept; Analogy between heat and electricity flow; Thermal contact resistance; Critical thickness of insulation; Heat transfer from extended surfaces; Fins of uniform cross-sectional area; Errors of measurement of temperature in thermometer wells; Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction in one dimension only; Heisler charts. **(07 Hours)**

Unit - III

Convection: Forced Convection; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Empirical heat transfer relations; Relation between fluid friction and heat transfer; Liquid metal heat transfer. **(08 Hours)**

Unit - IV

Natural Convections: Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders; Horizontal plates and cylinders; and sphere; Combined free and forced convection; Introduction to condensation and boiling phenomena. **(08 Hours)**

Unit - V

Thermal Radiation: Basic radiation concepts; Radiation properties of surfaces; Black body radiation; Planck's law; Wein's displacement law; Stefan Boltzmann law; Kirchoff's law; Gray Body; Shape factor; Black-body radiation; Radiation exchange between diffuse non black bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation; Green house effect. **(07 Hours)**

Unit - VI

Heat Exchanger: Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers.

Introduction to Mass Transfer: Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusion through a stagnant gas film. **(07 Hours)**

Recommended Books:

1. Heat Transfer; J.P. Holman; McGraw Hill International Edition.
2. Fundamentals of Heat and Mass Transfer; F. P. Incropera and D. P. De Witt; John Wiley and Sons.
3. Principles of Heat Transfer; Frank Kreith; McGraw-Hill Book Co.
4. Fundamentals of Momentum; Heat and Mass Transfer; James R. Welty; John Wiley & Sons (Pvt). Ltd.
5. Heat and Mass Transfer; Y.A. Cengel; Tata McGraw Hill.