Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
M. Tech. in Thermal Engg.	Advanced Heat and Mass Transfer	MET 503	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
I	3	3-0-0	3 Hours

Unit- I

Introduction: Reviews of basic laws of Conduction; Convection and radiation; Steady state heat conduction: Thermal insulation problem; Extended surfaces-fins with uniform cross-sectional area; Fins of variable cross-sectional area-circumferential; Triangular and parabolic shape; Fin effectiveness and efficiency; Thermal contact resistance; Multi-dimensional heat conduction: Analytical method and numerical methods. **(08 Hours)**

Unit- II

External Forced Convection: Introduction; The exact and approximate integral solutions for the flow over flat plate; Hydrodynamic & thermal boundary layer; Boundary layer thickness; Drag coefficient; The local & average heat transfer coefficient; Mass flow through the boundary; Turbulent flow over flat plate; Reynolds analogy; Reynolds-colburn analogy; Drag & heat transfer in mixed boundary layer; Flow across cylinders. **(08 Hours)**

Unit – III

Internal Forced Convection: Introduction; Entrance region; Fully developed region; Mean velocity; Mean temperature; Governing differential equation and velocity profile for fully developed laminar tube flow; Hagen-Poiseuille equation; Fanning friction coefficient; Heat transfer for fully developed laminar tube flow; Convection correlations for turbulent flow in tubes. **(08 Hours)**

Unit – IV

Two Phase Heat Transfer: Heat transfer with change of phase: Laminar film condensation on a vertical plate; Drop-wise condensation; Boiling regimes; nucleate and film boiling; Heat pipe. **(07 Hours)**

Unit –V

Heat Exchangers: Introduction; Heat exchanger analysis using LMTD and effectiveness–NTU method for multi-pass plate type and evaporative tubular heat exchanger; Heat exchanger Design; Optimization of heat exchanger.

(08 Hours)

Unit –VI

Thermal Radiation: Review of basic laws for radiation; Black body concept; gray body radiation; Solar radiations; Radiation between surfaces; Shape factor correlations; Radiation exchange between surfaces in black enclosure; Radiation exchange in gray enclosure; Apparent emissivity of a cavity; Radiation shields; Radiations in emitting and absorbing media. **(06 Hours)**

Recommended Books:

1. Heat and Mass Transfer; Y. A. Cengel; McGraw-Hill; 3rd Edition; 2007.
2. Fundamentals of Heat and Mass Transfer; Frank P. Incropera et. al.; John Wiley & Sons; New York; 7th Edition; 2011.
3. Heat & Mass Transfer; P. K. Nag; Tata-McGraw hill; 3rd Edition; 2011.
4. Fundamentals of Engineering Heat and Mass Transfer; R. C. Sachdeva; New Age International (P) Limited; New Delhi; 2nd Revised edition; 2006.
5. Heat Transfer; J. P. Holman; Tata-McGraw Hill; 9th Edition; 2004.