Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
M. Tech. in Thermal Engg.	Boiling; Condensation and Two-phase Flow	MET 507	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
I	3	3-0-0	3 Hours

Unit - I

Pool Boiling: Pool Boiling Curve; Heterogeneous bubble nucleation and ebullition; Nucleate boiling correlations; Hydrodynamic theory of boiling and critical heat flux; Film boiling; Transition boiling. **(07 Hours)**

Unit - II

Flow Boiling: forced-flow boiling regimes; flow boiling curves; Flow Patterns and Temperature Variation in Subcooled Boiling; Onset of Nucleate Boiling; Hydrodynamics of Subcooled Flow Boiling; partial flow boiling; Critical heat flux and post-chf heat transfer in flow boiling. **(07 Hours)**

Unit - III

Fundamentals of Condensation: basic processes in condensation; Thermal resistances in condensation; Taminar condensation on isothermal; Vertical and inclined flat surfaces; Empirical correlations; Internal-flow condensation and condensation on liquid jets and droplets; Choking in two-phase flow.

(08 Hours)

Unit - IV

Thermodynamic and Single-Phase Flow Fundamentals: States of matter and phase diagrams for pure substances; Transport equations and closure relations; Single-phase multi-component mixtures; Phase diagrams for binary systems; Transport properties; Turbulent boundary layer velocity and temperature profiles; Convective heat and mass transfer. **(07 Hours)**

Unit - V

Gas–Liquid Interfacial Phenomena: Surface tension and contact angle; Effect of surface-active impurities on surface tension; Thermocapillary effect; Disjoining pressure in thin films; Liquid–vapor interphase at equilibrium; Attributes of interfacial mass transfer; Two-dimensional surface waves on the surface of an inviscid and quiescent liquid **(08 Hours)**

Unit - VI

Two-Phase Mixtures; Fluid Dispersions and Liquid Films: Introduction; Time; Volume and composite averaging; Flow-area averaging; Important definitions; Particles of one phase dispersed in a turbulent flow field; Conventional, mini and micro-channels; Two-phase flow regimes- in adiabatic pipe flow; Vertical rod bundles. **(08 Hours)**

Recommended Books:

1. Two-Phase Flow; Boiling and Condensation In; Conventional and Miniature Systems; S. Mostafa Ghiaasiaan; Cambridge University Press; 1st Edition; 2008.
2. Handbook of Phase Change: Boiling and Condensation; S. G. Kandlikar; M. Shoji & V. K. Dhir; CRC Press; 1st Edition; 1999.
3. Convective Boiling and Condensation; John G. Collier; John R. Thome; Oxford University Press; 3rd Edition; 2001.
4. Two-phase Flow and Heat Transfer; P. B. Whalley; Oxford University Press; 1st Edition; 1996.
5. Fundamentals of Multiphase Flow; Christopher E. Brennen; Cambridge University Press; first Edition; 2005.