4th Semester	**RAG4G001**	**Heat & Mass Transfer**	**L-T-P 3-0-0**	**3 CREDITS**

Module I (10 Hours)

Modes of heat transfer- different modes of heat transfer, conduction, convection and radiation, units and dimension, Conduction- Fourier's equation, thermal conductivity, thermal conductivity of different materials, thermal diffusivity, variable thermal conductivity, electrical analogy; derivation of general equation of heat conduction in cartesian coordinate, derivation of general equation of heat conduction in cylindrical and spherical coordinate, analysis of one dimensional steady state conduction equation through plane walls, problems and solutions, study of one dimensional steady state conduction with internal heat generation in plane wall, cylinder and sphere , problems and solutions.

Module II (8 Hours)

Fins and Insulation - Analysis of fin equation, application of fin equation, problems and solutions; Insulation - Critical thickness of insulation; principle, analysis of critical thickness of insulation in cylinder and sphere, Insulation material, problems and solutions.

Module III (10 Hours)

Convection - Principle, hydrodynamic and thermal boundary layer on flat plate and in a tube, heat transfer co- efficient in convection, Newton's law of cooling; Forced convection on flat plate - Analysis of forced convection on flat plate, problems and solutions; Forced convection in a tube - Analysis of forced convection in a tube, problems and solutions; Combined forced & free convection; Dimensional analysis - Useful non-dimensional numbers like Reynold number, Prandtl dumber etc, dimensional analysis of free and forced convection , Empirical relationship.

Module IV (10 Hours)

Radiation - Principle, electromagnetic radiation, black body, grey bodies, Monochromatic radiation; Radiation properties - Absorptivity , reflectivity and transmissivity of radiation, Emissive power, solid angle, radiation intensity etc; Radiation laws - Basic laws of radiation, Planck's law, Stefan-Boltzman's law , Kirchoff's law etc , problems and solutions; Radiation exchange - Introduction, surface geometric configuration factor, Surface resistance, space resistance, problems and solutions; Radiation exchange between black surfaces, problems and solutions; Radiation shield - basic equation of radiation shield, application, Problems and solutions.

Module V (7 Hours)

Heat exchanger and Mass Transfer by Diffusion and Convection - Introduction, types of heat exchangers, fouling factors; Heat exchanger analysis to parallel and counter flow heat exchanger, log mean temperature difference(LMTD), problems and solutions; Heat exchanger performance, number of transfer unit (NTU), problems and solutions; Mass transfer by diffusion - Principle, Fick's law, problems and solutions; Mass transfer by convection - Principle, mass transfer coefficient, non-dimensional numbers associated with mass transfer, Reynolds analogy, problems and solutions.

Books:

- Gupta C P and Prakash R. 1994. Engineering Heat Transfer. Nem Chand and Bros., Roorkee.
- Kumar D.S., 2008. Engineering Thermodynamics, S.K. Kataria& Sons, 4424/6, Guru Nanak Market, NaiSarak, Delhi – 110006.
- Holman J P.1989. Heat Transfer. McGraw Hill Book Co., New Delhi.
- Incropera F P and De Witt D P.1980. Fundamentals of Heat and Mass Transfer. John Wiley and Sons, New York.