III Year II Semester	**L**	**T**	**P**	**C**
Code: 20ME6013	**3**	**0**	**0**	**3**

HEAT TRANSFER
(Heat transfer data book allowed)

Course Objectives:
The Students will acquire the knowledge
1. To interpret the concepts underlying one Dimensional Steady State Conduction Heat Transfer.
2. To discuss about extended surfaces one dimensional transient conduction heat transfer.
3. To outline the concepts of forced and free convection heat transfers.
4. To discuss the concepts underlying boiling and condensation heating transfers and heat exchangers.
5. To outline the concepts in radiation heat transfer.

UNIT–I INTRODUCTION
Modes and mechanisms of heat transfer – basic laws of heat transfer – General discussion about applications of heat transfer.
Conduction Heat Transfer: Fourier rate equation – general heat conduction equation in cartesian, cylindrical and Spherical coordinates. Steady, unsteady and periodic heat transfer – initial and boundary conditions.
One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – critical radius of insulation

UNIT–II EXTENDED SURFACE (FINS) HEAT TRANSFER
Long fin, fin with insulated tip and short fin, application to error measurement of temperature.
One dimensional transient conduction heat transfer:
Systems with negligible internal resistance – significance of Biot and Fourier numbers - chart solutions of transient conduction systems

UNIT–III CONVECTION
The convective heat transfer coefficient. Classification of convective heat transfer. Introduction to thermal boundary. Dimensionless numbers in heat transfer and their significance. Dimensional analysis.

FORCED CONVECTION
External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer – flat plates and cylinders. Internal Flows: Concepts about hydrodynamic and thermal entry lengths – division of internal flow based on this – use of empirical relations for horizontal pipe flow and annulus flow. FREE CONVECTION: Development of hydrodynamic and thermal boundary layer along a vertical plate– use of empirical relations for vertical plates and pipes.

UNIT-IV HEAT TRANSFER WITH PHASE CHANGE
Boiling: Pool boiling – regimes - calculations on nucleate boiling, critical heat flux and film boiling.

Condensation: Film wise and drop wise condensation – Nusselt's theory of condensation on a vertical plate- film condensation on vertical and horizontal cylinders using empirical correlations.
HEAT EXCHANGERS:
Classification of heat exchangers – overall heat transfer coefficient and fouling factor –concepts of LMTD and NTU methods – Problems.

UNIT–V RADIATION HEAT TRANSFER
Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann – heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

TEXT BOOKS
1. Heat Transfer/JP HOLMAN/TMH
2. Heat Transfer/P.K. Nag/TMH
3. Principles of Heat Transfer / Frank Kreith, RM Manglik & MS Bohn / Cengage learning Publishers
4. A Textbook of Heat and Mass Transfer / RK Rajput / S.Chand Publishing

REFERENCES
1. Heat and Mass Transfer / Arora and Domkundwar / Dhanpatrai & sons
2. Fundamentals of Engg. Heat and Mass Transfer/ R.C. Sachdeva/ New Age International
3. Heat and Mass Transfer/ Cengel/ McGraw Hill.
4. Heat and Mass Transfer / D.S. Kumar / S.K.Kataria & Sons
5. A Textbook on Heat Transfer - 4^{th} Edition / S.P Sukhatme / Universities Press

Course Outcomes
Upon successful completion of this course, the students will be able to:
1. Illustrate the concepts underlying one Dimensional Steady State Conduction Heat Transfer.
2. Explain about extended surfaces one dimensional transient conduction heat transfer.
3. Summarize the concepts of forced and free convection heat transfers.
4. Describe the theory underlying boiling and condensation heating transfers and heat exchangers
5. Outline the concepts in radiation heat transfer.