JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA 533003, Andhra Pradesh, India
DEPARTMENT OF MECHANICAL ENGINEERING

III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
HEAT TRANSFER **(Heat transfer data book is allowed)**					

Course objectives:

1) To gain knowledge about mechanism and modes of heat transfer.
2) To understand the concepts of conduction and convective heat transfer.
3) To gain knowledge about the forced and free convection.
4) To understand the concepts of heat transfer with phase change and condensation along with heat exchangers.
5) To gain knowledge about radiation mode of 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 – simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation. Variable Thermal conductivity – systems with heat sources or Heat generation-Extended surface (fins) Heat Transfer Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.

UNIT– II:

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham π Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers Concepts of Continuity, Momentum and Energy Equations

UNIT– III:

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.

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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 using LMTD and NTU methods.

UNIT– V:

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchhoff, 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 by HOLMAN, Tata McGraw-Hill.
2) Heat Transfer by P.K.Nag, TMH.

REFERENCE BOOKS:

1) Fundamentals of Heat Transfer by Incropera& Dewitt, John Wiley.
2) Fundamentals of Engineering, Heat& Mass Transfer by R.C.Sachdeva, NewAge.
3) Heat& Mass Transfer by Amit Pal – Pearson Publishers.
4) Heat Transfer by Ghoshadastidar, Oxford University press.
5) Heat Transfer by a Practical Approach, YunusCengel, Boles, TMH.
6) Engineering Heat and Mass Transfer by Sarit K. Das, DhanpatRai Pub.

Note: Heat and Mass transfer Data Book by C P Kothandaraman and Subrahmanyan is used to design and analyze various thermal processes and thermal equipment.

Course outcomes: At the end of the course, student will be able to

CO1: Apply knowledge about mechanism and modes of heat transfer.
CO2: Understand the concepts of conduction and convective heat transfer.
CO3: Learn about forced and free convection.
CO4: Analyze the concepts of heat transfer with phase change and condensation along with heat exchangers.
CO5: Interpret the knowledge about radiation mode of heat transfer.