Subject Code: 01ME1602
Subject Name: Heat Transfer
B. Tech. Year - III (Semester - 6)

Type of course : Science

Prerequisite : Thermodynamics, Fluid Mechanics

Rationale : The course is prepared to provide the detailed understating of heat transfer principles.

Course Outcome :

After completion of this course, student will be able to

1. Understand the modes and phenomenological origin of laws for the different modes of heat transfer
2. Analysis of heat conduction in a steady and transient state for various geometrics
3. Apply empirical correlation for analyzing free and forced convection problem
4. Evaluate the performance of heat exchangers by using the method of heat exchanger effectiveness
5. To analyze radiation heat exchange between surfaces and in diffuse, gray enclosure

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks					
				Theory Marks			Practical Marks		Total Marks
Theory	Tutorial	practical	C	ESE(E)	IA	CSE	Viva (V)	Term Work (TW)	
3	0	2	4	50	30	20	25	25	150

Content :

Sr. No.	Content	Total Hrs.
1	**Introduction to Heat Transfer** Basic concepts and laws of Conduction, Convection and Radiation, Difference between Thermodynamics and Heat Transfer, Thermal conductivity, Thermal diffusivity, General heat conduction equation in Rectangular, Cylindrical and Spherical coordinates and its reduction to specific cases.	**06**
2	**Conduction** Heat conduction in plane and composite wall including thermal resistance concepts, Heat conduction in multilayered cylinders and spheres, electrical analogy, Contact resistance, Overall heat transfer coefficient, Critical radius of insulation for cylinder and sphere.	**08**

3	**Extended Surfaces** Types and applications of fins, Heat flow through uniform cross section of fin, infinitely long fin, fin insulated at the tip and fin losing heat at the tip, Fin efficiency, Fin effectiveness	**05**
4	**Transient heat conduction** Transient heat conduction in solids having infinite thermal conductivity, Significance of Biot and Fourier number, Time constant, Transient heat conduction in solids with finite conduction and convective resistances	**04**
5	**Convection** Introduction to dimensionless number, Physical significance of dimensionless number, Dimensional analysis applied to natural and forced convection, Empirical correlations applied to natural and forced convection problems	**05**
6	**Heat exchanger** Types of heat exchanger, Analysis of heat exchanger, Log Mean Temperature Difference for parallel and counter flow heat exchanger, condenser and evaporator, overall heat transfer coefficient, Fouling factor, Correction factors for multi pass arrangement, Effectiveness and NTU method for parallel and counter flow heat exchanger	**07**
7	**Radiation** Radiation properties, blackbody radiation, Different laws of radiation, Intensity of radiation and solid angle, Lambert's cosine law, Radiation heat exchange between black bodies, Shape factor, Heat exchange between non-black bodies-infinite parallel planes and infinite long concentric cylinders by electrical analogy, Radiation shield, Heat exchange between two grey surfaces	**05**
8	**Boiling and Condensation** Boiling regimes, Film wise & drop wise condensation, laminar film condensation on vertical plate.	**02**

Distribution of Theory Marks

R Level	**U** Level	**A** Level	**N** Level	**E`** Level	**C** Level
10	**20**	**25**	**25**	**10**	**10**

Legends: R: Remember**; U:** Understand**; A:** Apply**; N:** Analyze**; E:** Evaluate**; C**: Create

List of experiments :

1. To analyze the conduction heat transfer in plane wall using ANSYS.
2. To analyze the conduction heat transfer in composite wall using ANSYS.
3. To analyze the conduction heat transfer in hollow cylinder using ANSYS.
4. To determine the thermal conductivity of the given composite walls.
5. To determine heat transfer co-efficient by natural convection.
6. To determine heat transfer co-efficient by forced convection.
7. To determine Stephan Boltzmann constant experimentally.

8. To determine the emissivity of the test plate.
9. To determine heat transfer co-efficient for transient heat transfer apparatus.
10. To determine the overall heat transfer co-efficient of tube and tube type heat exchangers.
11. To determine the overall heat transfer co-efficient of shell and tube type heat exchangers.
12. To determine convective heat transfer co-efficient of the fin under free convection.

Reference Books :

1. Heat & Mass Transfer by P.K. Nag, McGraw Hill
2. Heat and Mass Transfer: Fundamentals and Application by Yunus Cengel, McGraw
3. Fundamental of Heat and Mass Transfer by Incropera and Dewitt, Wiley Publication
4. Heat Transfer by Mills and Ganesan, Pearson Education
5. Heat Transfer by J P Holman , McGraw Hill
6. Heat & Mass Transfer by Arora & Domkundwar, Dhanpat rai and Co., NewDelhi
7. Engineering Heat & Mass Transfer by M.M. Rathore, Laxmi Prakshan
8. Heat & mass transfer by by D.S. Kumar, S.K. Kataria & Sons
9. Heat & Mass Transfer by R.K. Rajput, S. Chand & Co. New Delhi.

List of Open Base Software / learning website :

1. nptel.ac.in
2. www.learnerstv.com
3. cosmolearning.org