BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI – HYDERABAD CAMPUS

SECOND SEMESTER 2023-2024

Course Handout (Part II)

Date09-01-2024

In addition to part-I (General Handout for all courses appended to the time table), this portion gives further specific details regarding the course.

Course No. : **ME F220**
Course Title : **Heat Transfer**
Instructor-in-charge : **SATISH K DUBEY**
Lecture Instructors : Satish K Dubey, Mrinal K Jagirdar
Team of Instructors : Mrinal K Jagirdar,M Srinivas, K R C Murthy, Shaik Gouse Ahammad, Shine jude Hamilton, Suhas shreekrishna, Kalyani Panigrahi, Kiran Somisetti Vemu Sahiti

Fundamental concepts of heat transfer; steady-state and unsteady-state heat conduction; analytical and empirical relations for forced and free convection heat transfer; heat exchanger analysis and design; Heat transfer by radiation; condensation and boiling, associated laboratory.

1. **Scope and Objective:**
   This course is designed to make the students familiar with the concepts of heat and their applications in engineering. As a part of this course, students have to do the experiments through which they can correlate with their theoretical knowledge on the subject.
2. **Text Books:**
   T1: Frank P. Incropera, David P. Dewitt et al., Incropera's Principles of Heat and Mass Transfer, Wiley India Edition, 2018
3. **Reference Books:**
   R1 : J.P. Holman, Heat Transfer, McGraw Hill, 2002, 9th Edition.,

   R2 : F. Kreith & M. S. Bohn, Principles of Heat Transfer, Brooks Cole, 2000, 6th edition.
4. **Course Plan:**

Lecture No.	Learning Objectives	Topics to be covered	Reference Chap/Sec in Textbook/ Ref. Book
1	To revise the basic concepts of transport phenomena	Introduction to heat and mass transfer	Lecture notes 1.1-1.5 (T1)
2 – 3	To learn the basics of conduction heat transfer	Heat conduction equation	2.1-2.5 (T1)
4 – 5	To understand the analysis of one-dimensional steady state heat conduction	1D steady state heat conduction	3.1-3.5 (T1)
6– 7	To understand the heat transfer from extended surfaces	Finned Surfaces	3.6 (T1)
8– 10	To do the analysis of multidimensional steady state heat conduction	Two-dimensional steady state heat conduction, General consideration, method of separation of variables	4.1, 4.2 (T1)
11-13	To do the analysis of multidimensional steady state heat conduction	Finite difference method for heat conduction	4.4 -4.5(T1) and Lecture notes
14– 17	To learn heat transfer analysis of unsteady-state conduction	Lumped system analysis; analytical methods of analysis, numerical	5.1-5.10 (T1)
18-21	To learn the principles of convection heat transfer	Concepts and basic relations in convection heat transfer	6.1-6.7 (T1) and Lecture notes

22-24	To understand the forced convection heat transfer for External Flow	Analytical solutions for flow over flat plate, and empirical relations for external flow	7.1-7.3 (T1) and Lecture notes
25-28	To understand the forced convection heat transfer for internal flow	Analytical solutions and empirical relations for forced convection heat transfer	8.1-8.5 (T1) and Lecture notes
29-31	To understand the heat transfer analysis of natural convection systems	Analytical solutions and empirical correlation	9.1-9.4 (T1) and Lecture notes
32-34	To learn the design and analysis of heat exchangers	Types of heat exchangers; LMTD and NTU method of analysis	11.1-11.6 (T1)
35-36	To understand the basic laws of radiation	Basic laws and nature of thermal radiation	12.1-12.8, (T1) and Lecture notes
37-38	To learn the principles of radiation heat transfer	Radiation heat exchange between surfaces; radiation shields	13.1-13.3 (T1) and Lecture notes
39 – 40	To learn the principles condensation and boiling	Film wise, dropwise condensation, pool boiling, flow boiling basics	Chapter 10, and Lecture notes
41-42	Introduction to mass transfer	Analogy between heat and mass transfer, mass diffusion, Fick's law of diffusion, transient mass diffusion, mass convection, limitations of heat and mass transfer analogy.	Chapter 14, and Lecture notes

5. List of Experiments:

The list of experiments and complete modalities of operation of the laboratory such as the exact titles of experiments, reports submission and evaluation methodology etc. shall be announced at the beginning of laboratory session by the lab instructors.

List of Experiments

S. No.	Name of Equipment
1	Thermal Conductivity of Insulating Powder
2	Thermal Conductivity of Insulating Slab
3	Heat Transfer from Pin Fins
4	Thermal Conductivity of liquid
5	Heat Transfer in Forced Convection
6	Heat Transfer in Natural Convection
7	Emissivity Measurement Apparatus
8	Stefan Boltzman's Apparatus
9	Double Pipe Heat Exchanger
10	Pool Boiling Apparatus
11	Vertical and Horizontal Condenser
12	Convection Drying Equipment

6. Evaluation Schedule:

Evaluation Component	Duration (minute)	Weightage (%)	Marks	Date & Time	Nature of Component
Mid Semester Test	90	20	60	12/03 - 11.00 - 12.30PM	**CB**
Tutorial Test(s)	25 minutes	15	45	Evenly spaced throughout the semester during tutorial hour	**OB**
Lecture Quiz(s)	10 minutes	10	30	Evenly spaced throughout the semester during Lecture hour (Surprise in nature)	**OB**
Lab work *	-	20	60	Evenly spaced throughout the semester during Practical	**OB**
Comprehensive Exam	180	35	105	09/05 FN	**CB**

*Lab work

Evaluation Component	Duration (minute)	Weightage (%)	Date & Time	Nature of Component
Lab Reports	-	10%	Continuous During Practical hour	OB
Lab Viva/ quiz	-	10 %	Continuous During Practical hour	OB

NOTE:

7. **Chamber Consultation Hour**: To be announced in the class room.
8. **Notices**: All notices concerning this course shall be displayed on the CMS Students are advised to visit regularly **CMS** (institute's web based course management system) for updates on the course matters.
9. **Make-up Policy**: Make-up shall be given only to the genuine cases with prior intimation. No make-up will be given for the TUTORIAL and Lecture tests.
10. **Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and any type of academic dishonesty is not acceptable.

Instructor-in-charge
ME F220