**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI – HYDERABAD CAMPUS**

##### SECOND SEMESTER 2020-2021

**Course Handout (Part II)**

#### **Date16-01-2021**

In addition to partI (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**

**Instructorincharge : SATISH K DUBEY**

**Team of Instructors :**Supradeepan K, R Parameshwaran, Mrinal K Jagirdar, J Murali Mohan, Sunkara Prudhvi, Shaik Gouse A

1. **Course Description:**

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.

1. **Text Books:**

T1 : J.P. Holman, Heat Transfer, McGraw Hill, 2002, 9th Edition.

T2 : Srinivas, M & R.K. Mittal Transport Phenomenta-II Notes-EDD, 2003.(Data book)

1. **Reference Books:**

R1 : F. P. Incropera & D. P. Dewitt, Fundamentals of Heat and Mass Transfer,

John Wiley & Sons, 2001, 5th edition.

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

1. **Course Plan:**

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| --- | --- | --- | --- |
| **Lecture No.** | Learning Objectives | **Topics to be covered** | **Chapter in the Text Book** |
| 1 | To revise the basic concepts of transport phenomena | Introduction to heat and mass transfer | Lecture notes &  1.1 -1.4(T1) |
| 2 – 3 | To learn the basics of conduction heat transfer | Heat conduction equation | 1.1 – 1.2 (T1) |
| 4 – 5 | To understand the analysis of one-dimensional steady state heat conduction | 1D steady state heat conduction | 2.1 – 2.8 (T1) |
| 6 – 8 | To understand the heat transfer from extended surfaces | Finned Surfaces | 2.9 – 2.10 (T1) |
| 9 – 14 | To do the analysis of multidimensional steady state heat conduction | Analytical and numerical methods | 3.1 – 3.2 (T1)  3.4 – 3.6 (T1) Lecture notes |
| 15 – 17 | To learn heat transfer analysis of unsteady-state conduction | Lumped system analysis; analytical methods of analysis, numerical | 4.1 – 4.6(T1) |
| 18-19 | To learn the principles of convection heat transfer | Concepts and basic relations in convection heat transfer | 5.1-5.2 (T1) |
| 19-21 | To understand the forced convection heat transfer for flow inside ducts | Analytical solutions and empirical relations | 5.10, 5.11, 6.2 (T1) |
| 22-25 | To understand the forced convection heat transfer for flow over bodies | Analytical solution and empirical relations for forced convection heat transfer for flow over flat plate, cylinders, spheres and tube banks | 5.4 – 5.9, 5.12, 6.3 – 6.5 (T1)  Lecture notes |
| 26-27 | To understand the heat transfer analysis of natural convection systems | Analytical solutions and empirical correlation | 7.2 – 7.12 (T1)  Lecture notes |
| 28 | To understand the basic laws of radiation | Basic laws and nature of thermal radiation | 8.1-8.3 (T1) |
| 29 – 34 | To learn the principles of radiation heat transfer | Radiation heat exchange between surfaces; radiation shields | 8.4 – 8.8; 8.16 – 8.17 (T1) |
| 35– 37 | To learn the design and analysis of heat exchangers | Types of heat exchangers; LMTD and NTU method of analysis | 10.1 – 10.6 (T1) |
| 38 – 40 | To learn the principles condensation and boiling | Filmwise, dropwise condensation ,pool boiling, flow boiling basics | 9.1-9.2,9.4-9.5 (T1)  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. | 11.1-11.5 (T1)  Lecture notes |

1. **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 Force Convection |
| 6 | Heat Transfer in Natural Convection |
| 7 | Emissivity Measurement Apparatus |
| 8 | Stefen’s Boltzman Apparatus |
| 9 | Double Pipe Heat Exchanger |
| 10 | Pool Boiling Apparatus |
| 11 | Vertical and Horizontal Condenser |
| 12 | Convection Drying Equipment |

1. **Evaluation Schedule:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Evaluation Component | **Duration**  **(minute)** | **Weightage (%)** | **Marks** | **Date & Time** | **Nature of Component** |
| Mid Semester Test | 90 | 30 | 90 | 02/03 1.30 - 3.00PM | **OB** |
| Tutorial Test(s) | - | 10 | 30 | Evenly spaced throughout the semester during tutorial hour | **OB** |
| Lab work \* | - | 20 | 60 | Evenly spaced throughout the semester during Practical | **OB** |
| Comprehensive Exam | 120 | 40 | 120 | 05/05 FN | **OB** |

\***Lab work**

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

**NOTE:**

1. **Chamber Consultation Hour**: To be announced in the on line class room.
2. **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.
3. **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 tests.
4. **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**