

COURSE PLAN

Course Code : CH2004

Course Title : Advanced Heat transfer

Semester : II (M.TECH)

Course Time : January – April

Required Text Books:

1. Warren L. McCabe, Julian C. Smith and Peter Harriott, “*Unit Operations of Chemical Engineering*”, 7th ed., McGraw Hill International Edition, New York 2005.
2. Holman J.P., “*Heat Transfer*”, 9th ed., Tata McGraw Hill Book Co., New Delhi, 2008.
3. Coulson J.M., Richardson J.F., Backhurst J.R. and Harker J.H., “*Coulson & Richardson’s Chemical Engineering*”, Vol. I, 6th ed., Butterworth Heinemann, Oxford, 2009.
4. Donald Q. Kern, “*Process Heat Transfer*”, Tata McGraw Hill Book Co., New Delhi, 2008

Assessment Details:

Cycle test I : 20marks
 Surprise Test / Quiz : 5marks
 Assignment : 5marks
 Model Exam : 20 Marks

Test Schedule:

S.No	Date	Test	Topics	Duration
1	-	Cycle test-I	30%	100 min
2	-	Quiz/Surprise Test	20%	20 min
3	-	Assignment	30%	-
4	-	Model exam	100%	3 h

Outcomes

Students who have successfully completed this course will have full understanding of the following concepts

Course Outcome	Program Outcome
This course helps the students <ul style="list-style-type: none"> • To understand the steady and unsteady state heat transfer • To understand the various aspects of convective heat transfer operation • To understand the steps involved in the design of compact heat exchangers • To understand the heat transfer 	Students will: <ul style="list-style-type: none"> • Be able to understand the concepts of steady and unsteady state heat transfer • Be able to design the heat exchangers • Be able to understand the concepts of heat transfer in fluidized bed and

operation in fluidized bed and nuclear reactors.	nuclear reactors
<ul style="list-style-type: none"> To understand the concepts of transpiration cooling, ablation 	<ul style="list-style-type: none"> Be able to understand the concepts of transpiration cooling and ablation

Detailed Session plan:					
Session No.	Topics to be covered	Time (min)	Ref	Teaching method	Testing method
UNIT I – STEADY AND UNSTEADY STATE HEAT CONDUCTION (12 Hours)					
Steady and unsteady state heat conduction - Unsteady state heating and cooling of solid objects - Transient heat conduction - Extended surfaces and fins.					
1	Steady state heat conduction	50	1,2	BB	Group Discussion
2	Steady state heat conduction	50	1,2	BB	Problem solving
3	Steady state heat conduction	50	1,2	BB	Objective type test
4	unsteady state heating and cooling of solid objects	50	2	BB	Group Discussion
5	unsteady state heating and cooling of solid objects	50	2	BB	Problem solving
6	unsteady state heating and cooling of solid objects	50	2	BB	Problem solving
7	Transient heat conduction	50	2	BB	Group Discussion
8	Transient heat conduction	50	2	BB	Problem solving
9	Transient heat conduction	50	2	BB	Problem solving
10	Extended surfaces and fins	50	2	BB	Assignment
11	Extended surfaces and fins	50	2	BB	Assignment
12	Extended surfaces and fins	50	2	BB	Problem solving
UNIT II – CONVECTIVE HEAT TRANSFER (12 hours)					
Convection heat transfer coefficient - Dimensional analysis in convection heat transfer - Heat transfer during laminar and turbulent flow in closed conduits - Empirical correlations					
13	Dimensional analysis in convection heat transfer	50	1,2	BB	Assignment
14	Dimensional analysis in convection heat transfer	50	1,2	BB	Assignment
15	Dimensional analysis in convection heat transfer	50	1,2	BB	Assignment
16	Heat transfer during laminar flow in closed conduits	50	1,2	BB	Problem solving
17	Heat transfer during laminar flow in closed conduits - Empirical correlations	50	1,2	BB	Problem solving
18	Heat transfer during laminar flow in closed conduits	50	1,2	BB	Problem solving
19	Heat transfer during turbulent flow in closed conduits	50	1,2	BB	Problem solving
20	Heat transfer during turbulent flow in closed conduits	50	1,2	BB	Problem solving, Quiz
21	Heat transfer during turbulent flow in closed conduits	50	1,2	BB	Problem solving
22	Convection heat transfer coefficient	50	1,2	BB	Assignment

23	Convection heat transfer coefficient	50	1,2	BB	Cycle test - I
24	Convection heat transfer coefficient	50	1,2	BB	Problem solving
UNIT III – HEAT EXCHANGE EQUIPMENT					(12 hours)
Design of compact heat exchangers, design and selection of insulation.					
25	Design of compact heat exchangers	50	1,2,3	BB	Assignment
26	Design of compact heat exchangers	50	1,2,3	BB	Problem solving
27	Design of compact heat exchangers	50	1,2,3	BB	Problem solving
28	Design of compact heat exchangers	50	1,2,3	BB	Problem solving
29	Design of compact heat exchangers	50	1,2,3	BB	Problem solving
30	Design of compact heat exchangers	50	1,2,3	BB	Problem solving
31	Design of compact heat exchangers	50	1,2,3	BB	Group Discussion
32	Design of compact heat exchangers	50	1,2,3	BB	Assignment
33	Design of compact heat exchangers	50	1,2,3	BB	Problem solving
34	Design and selection of insulation	50	1,2	BB	Group Discussion,
35	Design and selection of insulation	50	1,2	PPT	Seminar
36	Design and selection of insulation	50	1,2	PPT	Seminar
UNIT IV – BOILING AND CONDENSATION					(12 hours)
Boiling and condensation heat transfer. Effect of turbulence and high vapor velocity on film wise condensation, Heat transfer in liquid metals.					
37	Boiling heat transfer	50	2	BB	Group Discussion
38	Boiling heat transfer	50	2	BB	Group Discussion
39	Boiling heat transfer	50	2	BB	Problem solving
40	Boiling heat transfer	50	2	BB	Problem solving
	Condensation heat transfer	50	2	BB	Group Discussion
41	Condensation heat transfer	50	2	BB	Problem solving
42	Condensation heat transfer	50	2	BB	Problem solving
43	Effect of turbulence and high vapor velocity on film wise condensation	50	2	BB	Quiz
44	Heat transfer in liquid metals	50	2	PPT	Group Discussion, Seminar
45	Heat transfer in liquid metals	50	2	BB	Problem solving
46	Heat transfer in liquid metals	50	2	BB	Assignment
47	Heat transfer in liquid metals	50	2	BB	Problem solving
48	Heat transfer in liquid metals	50	2	BB	Problem solving

UNIT V – SPECIAL TOPICS IN HEAT TRANSFER**(12 hours)**

Heat transfer in magneto fluid dynamic systems-transpiration cooling-ablation heat transfer in liquid metals-heat transfer in fluidized beds-heat transfer processes in nuclear reactors.

49	Heat transfer in magneto fluid dynamic systems	50	1,3	BB	Problem solving
50	Heat transfer in magneto fluid dynamic systems	50	1,3	BB	Problem solving
51	Transpiration cooling	50	1,3	BB	Group Discussion
52	Transpiration cooling	50	1,3	BB	Assignment
53	Ablation heat transfer in liquid metals	50	1,3	BB	Quiz
54	Ablation heat transfer in liquid metals	50	1,3	BB	Group Discussion, Seminar
55	Heat transfer in fluidized beds	50	1,3	BB	Problem solving
56	Heat transfer in fluidized beds	50	1,3	BB	Problem solving
57	Heat transfer in fluidized beds	50	1,3	BB	Problem solving
58	Heat transfer processes in nuclear reactors	50	1,3	BB	Problem solving
59	Heat transfer processes in nuclear reactors	50	1,3	BB	Problem solving
60	Heat transfer processes in nuclear reactors	50	1,3	BB	Problem solving