Course Code	Course Title	L	T	P	C
BMEE402L	Heat and Mass Transfer	3	0	0	3
Pre-requisite	BMEE203L	Syllabus version			
		1.0			

Course Objectives

1. To impart a comprehensive knowledge of various modes of heat and mass transfer.
2. To empower the students for solving heat transfer problems in the industry.
3. To equip the student in the design of heat exchangers.

Course Outcomes

At the end of the course, the student will be able to

1. Solve the steady and unsteady heat conduction problems for simple geometries
2. Analyse the natural and forced convective heat transfer processes
3. Design the heat exchangers using the LMTD and effectiveness-NTU methods
4. Solve the radiation heat transfer problems
5. Analyse the various mass transfer processes

Module:1	Conduction – I	8 hours

Fundamental laws; Identification of significant modes of heat transfer in practical applications. General equation of heat conduction in cartesian, cylindrical and spherical coordinates; One Dimensional steady state conduction in simple geometries - plane wall, cylindrical and spherical shells; Electrical analogy; Conduction in composite walls and shells; Critical thickness of insulation; Thermal contact resistance; Overall heat transfer coefficient; One dimensional steady conduction heat transfer with internal heat generation in plane walls, cylinders and spheres.

Module:2	Conduction – II	7 hours

Extended surfaces (Fins). Conduction shape factor; Unsteady state heat transfer - Systems with negligible internal resistance - Lumped heat capacity analysis; Infinite bodies - flat plate, cylinder and sphere; Semi-Infinite bodies - Chart solutions.

Module:3	Forced Convection	7 hours

Equations of conservation of mass, momentum and energy. Boundary layers for flow over a flat plate, curved objects and flow through circular pipes. External flow over flat plate, cylinder, sphere and bank of tubes; Internal flow through circular and non - circular pipes.

Module:4	Natural Convection	5 hours

Flow over vertical, horizontal and inclined plates; Flow over cylinders and spheres; Combined free and forced Convection; Introductory concepts of boiling and condensation.

Module:5	Heat Exchangers	6 hours

Classification of heat exchanger, LMTD, AMTD, Design of heat exchanger; Concentric pipe heat exchanger, shell and tube heat exchanger, cross - flow heat exchanger; Analysis epsilon - NTU method; Introduction to compact heat exchanger.

Module:6	Radiation	6 hours

Terminology and laws; black body, gray body; Radiation from real surfaces; Effect of orientation - view factor; Equivalent emissivity method, electrical analogy - surface and space resistances. Radiation shields.

Module:7	Mass Transfer	4 hours

Basic concepts - diffusion mass transfer - Fick's law of diffusion - steady state molecular diffusion - convective mass transfer - momentum, heat and mass transfer analogy - convective mass transfer correlations.		
Module:8	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**45 hours**
Text Books		
1.	Yunus A Cengel and Afshin J Ghajar, Heat and Mass Transfer: Fundamentals and Applications, 2015, 5th edition, McGraw-Hill.	
2.	Sachdeva R C, Fundamentals of Engineering Heat and Mass Transfer, 2017, 5th edition, New Age International.	
3.	Necati Ozisik M, Heat Transfer –A Basic Approach, 2016, McGraw Hill, New York.	
Reference Books		
1.	Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt, Fundamentals of Heat and Mass Transfer, 2018, 8th edition, Wiley.	
2.	J P Holman and Souvik Bhattacharyya, Heat Transfer, 2016, 10th edition, McGraw-Hill.	
3.	Kothandaraman, C.P, "Fundamentals of Heat and Mass Transfer", 2015, New Age International, New Delhi.	
Mode of Evaluation: CAT, Written assignment, Quiz, FAT		
Recommended by Board of Studies	30-11-2022	
Approved by Academic Council	No. 68	Date 19-12-2022