FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Mechanical Engineering)

Semester: VI

Course Code: 202090606

Course Title: Design of Heat Exchangers

Course Group: Professional Elective Course-II

Course Objectives: The course is design to provide fundamental knowledge of different type of heat exchangers used for thermal application.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Theory		J/V/P*		Total
				Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Basic design methodologies:** Classification of heat exchanger, selection of heat exchanger, Thermal-Hydraulic fundamentals, Overall heat transfer coefficient, LMTD method for heat exchanger analysis for parallel, counter, multi-pass and cross flow heat exchanger, e-NTU method for heat exchanger analysis, Rating and sizing problems, heat exchanger design methodology.	11
2	**Fouling of heat exchangers:** Basic consideration, effect of fouling on heat transfer and pressure drop, cost of fouling, design of heat exchangers subject to fouling, fouling resistance, cleanliness factor, techniques to control fouling.	06
3	**Design of Shell & tube heat exchangers:** Basic components, basic design procedure of heat exchanger, TEMA code, J-factors, conventional design methods, Bell-Delaware method.	12
4	**Multi-phase Heat exchanger:** Different types, Basic components, basic design procedure of heat exchanger **Condenser:** Shell and tube condenser, plate condenser, air cooled condenser, direct contact condenser, condenser for refrigeration and air-conditioning, thermal design of shell and tube condenser **Evaporator:** Evaporator for refrigeration and air-conditioning, thermal analysis of evaporator, standards for evaporators and condensers.	10

5	**Design of compact heat exchangers**: Heat transfer enhancement, plate fin heat exchanger, tube fin heat exchanger, heat transfer and pressure drop.	06
	Total	**45**

List of Practicals / Tutorials:

1	To understand the basic methodologies of Heat Exchanger.
2	To Understand the fouling in Heat Exchanger.
3	Design of heat exchange equipment by using LMTD method.
4	Design of heat exchange equipment by using effectiveness– NTU method.
5	Design and analysis of double pipe heat exchanger with parallel and counter flow arrangement.
6	Design and analysis of shell and tube type heat exchanger.
7	Design and analysis of plate type heat exchanger.
8	Design of evaporator for refrigeration system.
9	Design of condenser for refrigeration system.
10	Introduction to HTRI.

Reference Books:

1	Heat Exchanger Selection, Rating and Thermal Design by Sadik, Kakac, CRC Press
2	Fundamentals of Heat Exchanger Design by Ramesh K Shah, Wiley Publication
3	Heat Exchanger Design Handbook by Kuppan, T, Macel Dekker, CRC Press
4	Compact Heat Exchangers by Kays, V.A. and London, A.L., McGraw Hill
5	Heat Exchanger Design Handbook by Schunder E.U., Hemisphere Pub.
6	Process Heat transfer by Donald Q Kern, McGraw Hill

Supplementary learning Material:

1	NPTEL resources

Pedagogy:
- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Industrial/ Field visits

Internal Evaluation:
The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						R: Remembering; U: Understanding; A: Applying;
R	**U**	**A**	**N**	**E**	**C**	N: Analyzing; E: Evaluating; C: Creating
10%	20%	50%	10%	5%	5 %	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To understand the methodology of designing a Heat Exchanger.	**32**
CO-2	To understand how to select appropriate Heat Exchanger for the given application.	**22**
CO-3	To understand how to design common types of heat exchangers; namely shell-and-tube, compact Heat exchanger.	**20**
CO-4	To understand effect of pressure, drop and fouling in heat exchangers.	**16**
CO-5	To understand the application of various Heat Exchanger.	**10**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025