SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Mechanical Engineering Department
B. Tech. Semester VII

Course Name: **Design of Heat Exchanger** **Subject Code: BTME14713**
Type of course: **Professional Elective Course**
Prerequisite: Engineering Thermodynamics, Fluid Mechanics, Heat Transfer
Course Outline: The student will be able to understand thermal design and applications of different types of heat-exchangers, their economics, performance, design optimization and rating of the heat exchangers for various applications.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course.

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Introduction and Basic Design Methodology of Heat Exchangers:** Basic Concepts, Classification of heat exchanger, overall heat transfer coefficient, LMTD method for heat exchanger analysis for parallel, counter, multi-pass and cross flow heat exchanger, ε-NTU method for heat exchanger analysis, Selection of heat exchanger, fouling in heat exchangers.	12	24%

2.	**Double Pipe Heat Exchangers:** Basic Concepts, Thermal and hydraulic design of inner tube and annulus, hairpin heat exchanger with bare inner and multi tube finned inner tube, Pressure drop evaluation.	**8**	**18%**
3.	**Shell & Tube Heat Exchangers:** General Description, Basic design procedure, Kern Method, Stream analysis method, Bell-Delaware method, TEMA code.	**8**	**18%**
4.	**Compact Heat Exchangers:** General Description, Heat transfer enhancement, Extended surface or Fin, Fundamental of extended surface heat transfer, Tube Fin heat exchanger, Plate Fin heat exchanger, heat transfer and pressure drop evaluation.	**9**	**22%**
5.	**Heat Transfer Enhancement:** Enhancement of heat transfer, Heat Pipes, Heat Exchangers Network, Introduction to pinch analysis.	**8**	**18%**

Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):

Percentage Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**15**	**20**	**20**	**15**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyse, **E:** Evaluate **C:** Create and above Levels

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.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Heat Exchangers: Selection, Rating, and Thermal Design	SadikKakaç, Hongtan Liu, AnchasaPramuanjaroenkij	CRC Press 978-1439849903	2012	3rd
2.	Fundamentals of Heat Exchanger Design	Ramesh K. Shah, Dusan P. Sekulic	John Wiley Publication 0-471-32171-0	2003	--
3.	Heat Exchangers: Design, Experiment and Simulation	S. M. Sohel Murshed, Manuel Matos Lopes	InTech	2017	1st
4.	Heat Exchanger Design	Arthur P. Fraas	Wiley India Pvt Ltd	2011	2nd
5.	Heat Transfer	J P Holman Souvik Bhattacharyya	McGraw Hill Education	2017	10th

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Summarizing different types of heat exchangers with their basic design methodology.	30%
CO-2	Perform thermal and hydraulic design of different types of heat exchanger.	30%
CO-3	Identify the influencing parameters for design of heat exchangers.	30%
CO-4	Knowledge of Single phase and Multiphase heat transfer and friction coefficient correlations.	10%

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	2	1	1	1	1	0	0	0	0	0	0	0	3	0	0
CO-2	1	1	2	1	1	0	0	0	0	0	0	1	2	2	0
CO-3	2	1	1	0	0	0	0	0	0	0	0	0	1	0	0
CO-4	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0
Rationale*	6	4	5	2	2	0	0	0	0	0	0	2	7	3	0

Rationale - Mapping of CO's with PO's and CO's with PSO's:
This course highly maps with PO 1, 2, 3 and PSO 1. It states that the course will develop engineering knowledge to analysed complex engineering problems reaching substantiated conclusions using principles of natural sciences and engineering sciences, design solutions for complex engineering problems and design system components.

This course highly maps with PO and PSO. It states that the course will develop. This Course also focuses on Engineering knowledge, Problem analysis, Design / development of solutions, Conduct investigations of complex problems, Modern tool usage, The engineer and society, Environment and sustainability, Ethics, Individual and teamwork, Communication, Project management and finance, Life-long learning.

List of Practical:

1. Design of heat exchanger using LMTD method.
2. Design of heat exchanger using effectiveness– NTU method.
3. Measuring effectiveness of shell and tube heat exchanger.
4. Design and analysis of Parallel flow heat exchanger.
5. Design and analysis of Counter flow heat exchanger.
6. Design and analysis of Shell and tube type heat exchanger.
7. Bell Deware's method for shell and tube type heat exchanger design
8. Design and analysis of Plate type heat exchanger.

Major Equipment:

1. Shell and tube heat exchanger
2. Plate type heat exchanger
3. Tube in tube heat exchanger
4. Compact heat exchanger.

List of Open Source/learning website:

https://nptel.ac.in/courses/112/105/112105248/#

List of Open Source Software: Nil