B.E Semester: 8 Mechanical Engineering
Subject Name: Design of Heat Exchanger(ME803-N-D)
[Dept. Elect.-5]

Course Objective:

- To present a problem oriented in depth knowledge of Design Of Heat Exchanger Equipment
- To address the underlying concepts and methods behind Design Of Heat Exchanger Equipment

B. Teaching / Examination Scheme:

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
3	0	2	5	4	3	70	30	20	30	150

C. Detailed Syllabus:

Topic No.	Details
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, multipass and cross flow heat exchanger, e-NTU method for heat exchanger analysis, Fouling, Rating and sizing problems, heat exchanger design methodology
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
3	**Design of double pipe heat exchangers:** Thermal and Hydraulic design of inner tube and annulus, hairpin heat exchanger with bare and finned inner tube, total pressure drop
4	**Design of Shell & tube heat exchangers:** Basic components, basic design procedure of heat exchanger, TEMA code, J-factors, conventional design methods, Bell-Delaware method. **Design of compact heat exchangers:** Heat transfer enhancement, plate fin heat exchanger, tube fin heat exchanger, heat transfer and pressure drop
5	**Condensers and evaporators 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
6	**Heat transfer enhancement and performance evaluation:** Enhancement of heat transfer, Performance evaluation of Heat Transfer Enhancement technique. Introduction to pinch analysis

Total hours (Theory):48
Total hours (Practical):32
Total hours:80

D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1^{st} ,2^{nd} ,3^{rd}	Unit 1	20%	1 ,
2	4^{th} .5^{th} ,6^{th}	Unit 2	20%	2,3
3	7^{th} , 8^{th} ,9^{th}	Unit 3	20%	4
4	10^{th} .11^{th} . 12^{th}	Unit 4	20%	5
05	13^{th} , 14^{th} ,$15^{th,}$,16^{th}	Unit 5	20%	6

E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted toequivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overallinternal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for theconcept being taught in lectures. Suggested list of experiment is given below

F. List of Experiments :

1	Design of heat exchange equipment by using LMTD method.
2	Design of heat exchange equipment by using effectiveness– NTU method.
3	Design and analysis of double pipe heat exchanger with parallel and counter flow arrangement.
4	Design and analysis of shell and tube type heat exchanger.
5	Design and analysis of plate type heat exchanger.
6	Design of evaporator for refrigeration system.
7	Design of condenser for refrigeration system.
8	Case study on design of heat exchanger for process industry.

G. Students Learning Outcomes:

1	Learn how to design common types of heat exchangers; namely shell-and-tube, tube and tube.
2	Learn to select appropriate Heat Exchanger for the given application.
3	Become aware of single and multiphase heat transfer and friction coefficient correlations, and they will know how to select the appropriate ones for the case in hand

H. Text Books & 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	Compact Heat Exchangers by Kays, V.A. and London, A.L., McGraw Hill
4	Heat Exchanger Design Handbook by Kuppan, T, Macel Dekker, CRC Press
5	Heat Exchanger Design Hand Book by Schunder E.U., Hemisphere Pub.
6	Process Heat transfer by Donald Q Kern, McGraw Hill