GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL (COMPUTER AIDED PROCESS DESIGN) (16)

COMPUTER AIDED DESIGN IN HEAT TRANSFER

SUBJECT CODE: 3711609

SEMESTER: I

Type of course : Core Course - 2

Prerequisite: Process Heat Transfer, Process Equipment Design

Rationale: Process heat transfer deals with the rates of heat exchange as they occur in the heat transfer equipment of the engineering process. This approach brings to better focus the importance of the temperature difference between the source and the receiver, which is, after all, the driving force whereby the transfer of heat is accomplished. Chemical industries deal with Heat exchangers such as No phase change, Condensor, Reboiler and Vaporizers etc. Detailed study of process design of these heat exchangers is important.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	4	5	70	30	30	20	150

Content

Sl. No.	Topic	Teaching Hours	Module Weightage (%)
1.	**Computer aided Process design of Shell & Tube Heat exchangers**: Process design of Shell & Tube heat exchangers, Functions of various parts of shell & Tube Heat exchanger, General design method of shell & tube heat exchanger, Criteria of selection among Fixed Tube sheet, U Tube & Floating Head heat exchanger, Process design of without phase change heat exchanger, Process design of condenser, Criteria of selection for Horizontal and vertical condenser, Condensation with non-condensables, Multicomponent Condensation, Tinker's flow model, Delaware Method for Design of baffled Shell & Tube heat exchangers. Use of software to solve the problems of process design such as HTRI, Excel and SCILAB programming.	27	56
2	**Computer aided Process design of Air cooled heat exchangers and air Heaters:** Air side or Fin side Heat Transfer Coefficient and pressure drop. Software preparation for this application.	6	13

3	**Computer aided Process design of Plate heat exchangers:** Advantages and Disadvantages of Plate Heat Exchangers over Shell and Tube Heat Exchangers. Calculation of heat transfer coefficient and pressure drop. Software preparation for this application.	4	8
4	**Computer aided Process design of Reboilers and Vaporizers:** Process design of Kettle-type Reboiler, Process design of Vertical Thermosyphon Reboiler, Criteria of selection between Kettle-type Reboiler and Thermosyphon Reboiler. Preparation of computer program for this application.	11	23
		48	100

Reference Books:

1. Introduction to Process Engineering and Design by S B Thakore and B I Bhatt, Tata McGraw Hill, 2nd Edition.
2. Brownell and Young, Process Vessel Design, Wiley Eastern, 1977.
3. TEMA Standards.
4. Chemical Engineering, Mc Graw Hill, Coulson and Richardson, Vol.6

Course Outcome:

1. Students will be capable to do process design the shell & tube heat exchangers useful for different applications.
2. Students will be capable to do proper selection of chemical equipment for requirement.
3. Reboiler and Vaporisers can be designed by the students.

List of Experiments:

Tutorials/Presentation/Practical based on above topics.

1. Process design of Shell & Tube heat exchanger
2. Process design of Condensor for pure component
3. Process design of condenser with non-condensables
4. Process design of condenser with subcooling
5. Process design of Air Heater or Air cooler
6. Process design of Plate heat exchanger
7. Process design of Kettle type Reboiler
8. Process design of Thermosyphon Reboiler
9. Delware method for design of shell & tube heat exchanger
10. Multicomponent Condensation

List of Open Source Software/learning website:

1. Students can refer to video lectures available on the websites including NPTEL lecture series.
2. Students can refer to the CDs available with some reference books for the solution of problems using softwares/spreadsheets. Students can develop their own programs/spreadsheets for the solution of problems.