# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Master of Engineering**

**Level: PG**

**Branch: Computer Aided Process Design**

**Course / Subject Code: ME01072021**

**Course / Subject Name : Computer Aided Design In Heat Transfer**

| | |
|---|---|
| w. w. e. f. Academic Year: | 2024-25 |
| Semester: | 1st Semester |
| Category of the Course: | PCC |

| | |
|---|---|
| **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:**

| | | | **Total Credits L+T+ (PR/2)** | **Assessment Pattern and Marks** | | | | **Total Marks** |
|---|---|---|---|---|---|---|---|---|
| | | | | **Theory** | | **Tutorial / Practical** | | |
| **L** | **T** | **PR** | **C** | ESE (E) | PA / CA (M) | ESE (V) | PA/CA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 20 | 30 | 150 |

**Course Content:**

| Unit No. | Content | No. of Hours | % of 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. | 25 | 56 |

| | | | |
|---|---|---|---|
| 2. | **Computer aided Process design of Air cooled heat exchangers andair 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 andTube Heat Exchangers. Calculation of heat transfer coefficient andpressure 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. | 10 | 23 |
| | **Total** | **45** | **100** |

**Course Outcomes:**

After Completion of the Course, Student will able to:

| No. | Course Outcomes | |
|---|---|---|
| 01 | Design the shell & tube heat exchangers useful for different applications. | A,C, E |
| 02 | Selection of chemical equipment for requirement. | A |
| 03 | Interpret design of Reboiler and Vaporisers. | A,N |

**Suggested Specification Table with Marks (Theory):**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| **R Level** | **U Level** | **A Level** | **N Level** | **E Level** | **C Level** |
| - | - | 35 | 30 | 20 | 15 |

*Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as perRevised Bloom's Taxonomy)*

**References/Suggested Learning Resources:**

1. **Books:**
2. Introduction to Process Engineering and Design by S B Thakore and B I Bhatt, Tata McGraw Hill, 2nd Edition.

**3.** Brownell and Young, Process Vessel Design, Wiley Eastern, 1977.
**4.** TEMA Standards.
**5.** Chemical Engineering, Mc Graw Hill, Coulson and Richardson, Vol.6

**(a) Open-source software and website:**

1. NPTEL lecture series.

**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

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