| Course Type | Course Code | Name of the Course | L | T | P | Credits |
|---|---|---|---|---|---|---|
| OE | CHO401 | Process Integration | 3 | 0 | 0 | 9 |

| **Course Objective** |
|---|
| To introduce concepts, aimed at selecting the best among all the alternatives for various process operations as well as perspectives for integration of different unit operations in process industries. |
| **Learning Outcomes** |
| Students shall be able to design and analyze complex network of unit processes – specifically related to synthesis of heat exchanger networks, distillation columns and reactors. |

| Unit No. | Topics to be Covered | Lecture Hours | Learning Outcome |
|---|---|---|---|
| 1 | **Introduction:** Introduction to hierarchical approach for process engineering design, the nature of chemical process, formulation of design problem, the hierarchy of chemical process | **07** | Students will have understanding of basic concepts of conceptual process design, technology selection, and integration |
| 2 | **Economic and Decision Making:** Role of economic in technology selection, calculation of economic potential, time value of money | **03** | Students will have understanding of economic importance of technology selection |
| 3 | **Reactor Selection:** Decision making based on input information, reaction path, reactor performance, choice of reactors, batch vs continuous | **07** | Students will have understanding of selection of reactors, material and energy balance |
| 4 | **Separation and Recycling:** Selection of separation technologies and recycle operations, general structure of separation system, selection of recycle stream, compressor design and cost | **07** | Students will have understanding of importance and selection of separators as well as recycling units in process industries. |
| 5 | **Pinch Technology:** Introduction, basic concept, role of thermodynamic laws, problem addressed by pinch technology | **07** | Students will have understanding of Pinch technology widely employed to minimize energy losses |

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|---|---|---|---|
| **6** | **Heat Exchanger Networks:** Designing of HEN, pinch design methods, design of maximum energy recovery (MER) | **07** | Students will have understanding of heat exchanger network which has critical role in profitability and energy optimization of any process |
| **7** | **Heat Integration:** Heat integration of equipment: heat engine, heat pump, distillation column | **04** | Students will have understanding of heat integration which helps to minimize energy losses |

**Textbooks:**

1. Kemp I. C. (2007). Pinch Analysis and Process Integration: A user Guide on Process Integration for the Efficient Use of Energy. 2nd Ed., Butterworth-Heinemann
2. Smith R. (2005). Chemical Process Design and Integration. 2nd Ed., Wiley
3. Shenoy U. V. (1995). Heat Exchanger Network Synthesis. Gulf Publishing Company
4. Douglas, J. M. (1998). Conceptual Design of Chemical Processes, McGraw Hill

**Reference Books:**

1. El Halwagi M. M. (2006). Process Integration. 7th Ed., Academic Press