

## Plant Design and Economics

- 1.1 Course Number: CH413
- 1.2 Contact Hours: 3-0-2 Credits: 11
- 1.3 Semester -offered: 4<sup>th</sup> Year-odd
- 1.4 Prerequisite: Nil
- 1.5 Syllabus Committee Member: Dr Rakesh Kumar, Dr Vivek Kumar

1. **Objective:** The objective of the course is to provide knowledge for the development of chemical processes and their economics.

2. **Course Content:**

Unit wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Introduction to Plant Design	Basic consideration in Chem. Engg. plant design, Project identification, Preliminary techno-economic feasibility. Selection of process, Factors affecting process selection, Types of flow diagrams.	4
2	Separation System Synthesis	Distillation column sequencing for ideal liquid mixtures, Separation system structure for non-ideal mixtures using distillation, Residue curves, Distillation models of standard versus special equipment	8
3	Process Auxiliaries and Utilities	Piping design, layout, support for piping insulation, Types of valves, Process water, Boiler feed water, Water treatment & disposal, Steam, Oil heating system, Chilling plant, Compressed air and vacuum system	8
4	Heat Exchanger Network Synthesis	Pinch technology: Targets for minimum utilities, maximum energy recovery design	6
5	Cost Estimation	Estimation of capital costs, purchased equipment costs, the total capital cost of a plant, bare module cost-base and non-base conditions, estimation of manufacturing costs, cost of labor, utility cost, raw material costs	6

6	Depreciation	Investment and the time value of money, Different types of interest, Cash flow diagrams, Inflation, Annuities, Depreciation, Taxation, Profitability analysis, Net present value, The rate of return, evaluation of equipment alternatives	4
7	Profitability	Alternative investment & replacement methods for profitability evaluation, Economic consideration in process and equipment design, Inventory control	3
8	Laboratory Classes	There will be 8-10 experiment designed based on the theory covered in the lectures.	2 hours/ week
<b>Total</b>			<b>Lecture: 40</b>

#### 4. Readings

##### 4.1 Text Books:

1. Seider, W. D., Seader, J. D., and Lewin D. R., Process Design Principles, Wiley, New York, 1999.
2. Peters, M.S, Timmerhaus, K.D., West, R.E, Plant design and economics for chemical engineers, 5<sup>th</sup> ed., McGraw Hill, 2004.

##### 4.2 Reference Books:

1. Douglas, J. M., Conceptual Design of Chemical Processes, 4th Ed., McGraw Hill, New York, 1988.
2. Coker, A. K., Ludwig's Applied Process Design for Chemical and Petrochemical Plants, Vol. 1, 4th Ed., Gulf, Houston, TX, USA, 2007

- 5 **Outcome of the Course:** To equip students to design the essential elements of a chemical engineering process (equipment sizes, material & energy balances and economics). To provide experience using commercial process simulation software such as ASPEN plus. Use ASPEN Plus to simulate various scenarios of units and groups of units. To carry out various group projects to simulate the complete plant and analyze process performance, identify opportunities, troubleshoot problems, and recommend changes.