

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, K.K. BIRLA, GOA CAMPUS
INSTRUCTION DIVISION
FIRST SEMESTER 2020-2021
Course Handout (Part II)

Date: 18/08/2020

Course No. : CHE F314
Course Title : Process Design Principles – 1
Instructor-in-charge : Prof. S. D. Manjare
Instructor (Lectures/Tutorial) : : Prof. S. D. Manjare / Karthick Raja

1. COURSE DESCRIPTION

The design process, hierarchical approach to conceptual design, generation of process alternatives and use – of order of magnitude analysis, process creation and heuristics, overall & recycle material balance and stream costs, separation trains, rigorous material balance, heat- exchanger networks, heat & power integration, mass exchanger network and , process simulation using Aspen Plus to assist in process modeling.

2. SCOPE AND OBJECTIVE OF THE COURSE

The course aims to describe to students modern and latest design strategies involved in the design of chemical processes. This course mainly deals with the process synthesis part of process design. It covers in detail the evaluating and choosing the best process from various alternate processes available. The new approach of energy integration will be discussed in detail with emphasis on heat exchanger networks followed by mass exchanger network.

3. TEXT BOOK

1. Seider D. Warren, Seider D. J., Lewin Daniel, “Product and Process Design Principles, Wiley, 2nd Edition, 2004
2. James M Douglas, “Conceptual Design of Chemical Processes”, Tata McGraw Hill

4. REFERENCE BOOKS

1. Richard Turton et. al., Analysis, Synthesis and Design of Chemical Processes”, Prentice Hall

5. COURSE PLAN

Lecture No.	Learning Objectives	Topics to be covered	Ref./Ch./Sec
1-3	Introduction to the course, general consideration to plant design, design process, nature of process synthesis and analysis	Introduction, creative aspects of the process design, hierarchical approach to conceptual design	1.1-1.2 of TB1, Class notes, & 1.1-1.2 of TB2
4	The Design Process	Environmental and safety conditions in design, Engineering ethics, Safety, role of computers in design	1.3-1.6 (TB1)
5-6	Generation of Process alternatives and use – of order of magnitude analysis	Design of a gas absorber, systems approach versus unit operation approach, Rules of thumb	3.1-3.5 (TB2)
7-8	Process Creation	Objectives, Preliminary database creation, Experiments	3.1-3.3 (TB1)
9-10	Process creation	Preliminary Process Synthesis with examples,	3.4 (TB1)
11-12	Process creation	Development of Base case design and Concept of process flow diagrams	3.5 (TB1)
13 – 14	Simulation to assist in Process creation	Concepts of process simulation, Steady and unsteady state simulation	Chap 4(TB1)
15-16	Input information that is needed at the initial stages of the design problem and Heuristics of batch vs continuous decision	Input information and Batch Vs Continuous Processes	4.1 -4.2 (TB2)
17– 20	Heuristics on input- output & recycle structure of the flow sheet	Introduction, raw materials, chemical reactions, overall & recycle material balance and stream costs	5.1-5.3 (TB1) and 5.1-5.2 & 6.1-6.4 (TB2)
21 – 22	Heuristics on separation system	Separations, heat removal from and addition to reactors, heat exchangers and furnaces,	5.4 – 5.6 and (TB1), 7.1-7.3 (TB2)
23 – 24	Heuristics on Pumping and Size Reduction	Pumping, Size separation of particles	5.7-5.8 (TB1)
25	Synthesis of Separation trains	Introduction, Criteria for selection of separation methods	7.1-7.2 (TB1)
26 – 27	Synthesis of Separation trains	Selection of equipment, Sequencing of ordinary and complex distillation columns	7.3-7.4 (TB1) & 7.3 (TB2)
28-29	Rigorous material balances	Liner material balancing	7.5(TB2)
30 – 37	Heat- Exchanger Networks	Introduction to Pinch technology, Minimum utility targets, TI method, Design of Minimum-Energy Heat-Exchanger Networks Concept of stream splitting, area estimates	8.1 – 8.7 (TB2)
38 – 40	Heat and Power Integration	Heat Engines, heat pumps, heat and distillation	8.8-8.9 (TB2)

6. EVALUATION SCHEME

EC No.	Evaluation Component	Duration	Weightage %	Date & Time	Remarks
1.	Test 1 Test 2 Test 3	30 minutes 30 minutes 30 minutes	15 15 15	Sep 17, 2020, 12noon-12.50pm Oct 15, 2020, 12noon-12.50pm Nov 17, 2020, 12noon-12.50pm	Closed Book/Open Book
3.	Quizzes / Assignments/ Simulation Training	-	20	To be announced in class	To be announced in class
4.	Comprehensive Exam	2 hours	35	02/12/2020 (FN)	Closed Book

- As a part of chamber consultation hour, students can consult I/C on Friday between 9.50 am to 10.30 am
- The notices will be sent via Google class room or moodle platforms
- No make-up will be granted for any component. However, in genuine cases, I/C may consider makeup application (applied before the said examination) after verifying the facts. Prior application (to I/C) for makeup is mandatory.

**Instructor-in-charge
CHE F314**

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