BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
First Semester 2021-2022
Course Handout (Part-II)

20-08-2021

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No.   : CHE F314
Course Title   : Process Design Principles I
Instructor-in-Charge: Prof. Vikranth Kumar Surasani

Scope & Objective:
The course as a whole, Process Design Principles, is designed to bring together the concepts of engineering and economics for chemical plant design and optimization. In the first part of this course in this semester i.e. in **Process Design Principles I**, student can learn how to combine the individual aspects of chemical engineering such as fluid mechanics, mass transfer, heat transfer, chemical reaction engineering, chemical process calculations, thermodynamics, process equipment design etc. for designing of a efficient chemical plant that may be economically feasible. The hierarchy of decisions in synthesis and analysis of a chemical process and its alternatives is initially discussed. Various stages of the chemical process design are addressed step by step such as input-output structure, material and energy balance calculations, design of separation processes and heat integration of the process (or heat exchanger network in the process).

Text Books:
T1   Warren D. Seider, J. D. Seader, and Daniel R. Lewin, "Product & Process Design Principles: Synthesis, Analysis, and Evaluation", John Wiley & Sons, New York, 2nd Edition (2004).

Additional Reference Books:
R1   T James M. Douglas, "Conceptual Design of Chemical Processes", McGraw Hill, New York, International Edition (1988).

R1   Aspen manuals and help

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-3	The Design Process	Primitive Design Problems; Steps in Designing; Environmental Protection; Safety Considerations	Ch. 1 of T1
4	Introduction to Simulation Tools	Aspen/HYSYS/Matlab	Aspen Manuals Aspen
5-9	Process Creation	Preliminary Data Creation; Experiments; Data Analysis: Regression and Interpolation; Preliminary Process Synthesis; Development of base-case scenario	Ch. 3 of T1
10-13	Heuristics For Process Synthesis	Recalling the process operations in process synthesis: Chemical reaction (to eliminate differences in molecular type); Mixing and recycle (to distribute the chemicals) Separation (to eliminate differences in composition); Temperature, pressure and phase change; Task integration (to combine tasks into unit operations)	Ch. 5 of T1
14-18	Reactor Design and Reactor Network Synthesis	Reaction Stoichiometry; Ideal Reactors; Reactor Network Design Using Attainable region	Ch. 6 of T1
18-21	Sequence of Separation Trains	Criteria for selecting the separation methods; Sequencing of ordinary distillation column for separation of near ideal fluid mixtures;	Ch. 7 of T1
22-26	Second Law Analysis	Limitations of First Law; Second Law, Thermodynamic Availability; Exergy, Loss of Work;	Ch. 9 of T1
27-31	Heat Exchanger	Introduction to HEN Synthesis	Ch.10 of T1

	Network Synthesis				& Ch.8 of R1
32-36	Advanced Hen Synthesis	Advanced HEN Synthesis Loops and Splits; Threshold problems			Ch.10 of T1 & Ch.8 of R1
37-40	Heat & Power Integration	Data Extraction Heat Integration in Design			Ch.10 of T1 & Ch.8 of R1

Note: Each week tutorial session will be taught in Aspen Plus/Matlab, which will take place in CAD lab.

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage (%)	Date& Time	Nature of Component
1.	Midterm	90 min	30	21/10/2021 11.00 - 12.30PM	Open Book
3.	Comprehensive	120 min.	40	18/12 FN	Open book Open Book
4.	Quizzes/Surprise tests		15		Open Book
5.	Aspen/Matlab Assignments*		15		Open Book

Chamber Consultation Hour: TBA

Notices: All notices concerning this course will be displayed on the Chemical Engineering Notice Board

Make-up Policy: Make-up is granted only for genuine cases having 85 % attendance with valid justification. A prior permission from the Instructor-in-charge is required.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
(Dr. Vikranth Kumar Surasani)
CHE F314