

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
INSTRUCTION DIVISION
Second Semester 2003-2004
Course Handout (Part-II)

Date :

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 C332

Course Title : **Process Design Decisions**

Instructor-in-Charge : **B.V.BABU**
Instructor : Ashish S. Chaurasia

Course Description:

Strategic designs in process synthesis & analysis; cost models; profitability measures & analysis; depreciation; engineering economics; hierarchy of levels of design decision making; batch vs. continuous; input-output structure of flow sheet; recycle structure of flow sheet; general structure of separation systems; energy integration analysis; pinch technology; cost diagrams & screening of process alternatives; preliminary process optimization; process retrofitting; case studies.

Scope & Objective:

This course introduces the student to the strategy of process engineering and provide an insight into various aspects of process design. This course mainly deals with the process synthesis part of process design. It covers in detail the evaluating and choosing the best from various alternate processes, different possible flow sheets, economic criteria and optimization procedures.

Text Books:

T1 James M. Douglas, "Conceptual Design of Chemical Processes", McGraw Hill, New York, International Edition (1988).

Reference Books:

- R1 Max Stone Peters, Klaus D. Timmerhaus, and Ronald West "Plant Design and Economics for Chemical Engineers", McGraw Hill, New York, 5th Edition (2002).
- R2 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).
- R3 Dale F. Rudd, and Charles C. Watson, "Strategy of Process Engineering", John Wiley & Sons, New York (1968).

Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Reference Chap./Sec. (Book)
1	Introduction to Process Design Decisions: Process Synthesis & Analysis.	Introduction	Ch. 1 of T1, R1 & R2
2-3	Creative aspects, Hierarchical approach to conceptual design, HDA Process.	Nature of Process Synthesis & Analysis	Ch. 1 of T1
4-15	Heat-Exchanger Network Synthesis (HENS), First law analysis, Cascade diagrams, Temperature-Enthalpy Diagrams, Grand composite curve, Multiple utilities, Area estimates, Design of MER Networks, Loops and paths, Final design, Stream splitting, Complete design algorithm, Heat and power integration.	Energy Integration Analysis	Ch. 8 of T1
16-19	Cost information, Capital & operating cost estimation, Total capital investment, Time value of money, Depreciation, Process profitability measures, Economic analysis simplification.	Engineering Economics for Conceptual Design	Ch. 2 of T1 & Ch. 5-9 of R1
20-23	Design of a solvent recovery system, Problem definition, Design of a gas absorber, Flow sheet, material and energy balances, and stream costs, Equipment design considerations, Rules of thumb	Economic Decision Making	Ch. 3 of T1 & Ch. 10 of R1
24-25	Input information, Level-1 decision (Batch vs. continuous), Systematic procedure for the design of batch processes.	Input Information and Batch vs. Continuous	Ch. 4 of T1
26-29	Level-2 Decisions (Input-output structure), Design variables, Selectivity and reaction stoichiometry, Overall material balances, Stream costs, Process alternatives, Economic potential (EP-2).	Input-Output Structure of the Flow sheet	Ch. 5 of T1
30-34	Level-3 Decisions (Recycle structure), Recycle material balances, Reactor heat effects, Equilibrium limitations, Compressor design and costs, Reactor design, Economic potential (EP-3).	Recycle Structure of the Flow sheet	Ch. 6 of T1
35-38	General structure, Vapor recovery system, Liquid separation system, Azeotropic systems, Rigorous material balances, Economic potential (EP-4).	Separation System	Ch. 7 of T1
39	Cost diagrams (CD), CD for complex processes, Quick screening of process alternatives, HDA process.	Cost Diagrams & Quick Screening of Process Alternatives	Ch. 9 of T1

40-41	Design variables and economic trade-offs, Cost models for process units, Cost model for a simple process, Approximate optimization analysis, Rank-order parameter, Proximity parameter.	Preliminary Process Optimization	Ch. 10 of T1
42	Systematic procedure for process retrofits, HDA process, Methods of estimation for rank-order & proximity parameters.	Process Retrofits	Ch. 11 of T1

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Date, Time & Venue	Nature of Component
1.	Test-I	50 mts.	20		Open Book
2.	Test-II	50 mts.	20		Closed Book
3.	Compre	3 hrs.	40		Closed Book
4.	Assignments		10		
5.	Surprise Quiz		10	See Note*	Open/Closed Book

***Note:** A total of six surprise tests/quizzes will be conducted in the tutorial hour. Out of these the performance in best four will be considered for final evaluation.

Chamber Consultation Hour: To be announced in the class.

Notices: All notices concerning this course will be displayed on the Notice Boards of Chemical Engineering Group & Workshop.

Make-up Policy: Make-up is granted only for genuine cases with valid justification and prior permission of Instructor-in-charge.

Instructor-in-charge
CHE C332