BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI-HYDERABAD CAMPUS
INSTRUCTION DIVISION, FIRST SEMESTER 2016-2017

Course Handout

Date: 01/08/2016

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 : **Lakshmi Sirisha P**

Course Description:
Process invention using heuristics and analysis; design process, process creation and heuristics for process synthesis. Detailed process synthesis using algorithmic methods with emphasis on reactor networks, separation trains, batch processes, heat integration network.

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, costing and optimization. In the first part of this course i.e. in **Process Design Principles I**, students will learn to combine individual aspects of chemical engineering course such as fluid mechanics, mass transfer, heat transfer, chemical reaction engineering, chemical process calculations, thermodynamics, process equipment design etc. for designing an efficient chemical plant. 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). Students will also learn to use ASPEN software for process simulations and optimization.

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).
R2 Aspen manuals

Course Plan:

Lecture	Contents	Topics	Reference
1-3	The Design Process	Primitive Design Problems; Steps in Designing; Environmental Protection; Safety Considerations	Ch. 1 of T1
4-7	Introduction to Simulation Tools	Aspen	Aspen Manuals Aspen
7-12	Process Creation	Preliminary Data Creation; Experiments;	Ch. 3 of T1

		Data Analysis: Regression and Interpolation; Preliminary Process Synthesis; Development of base-case scenario	
13-17	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
18-21	Reactor Design and Reactor Network Synthesis	Reaction Stoichiometry; Ideal Reactors; Reactor Network Design Using Attainable region	Ch. 6 of T1
22-25	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
26-30	Second Law Analysis	Limitations of First Law; Second Law, Thermodynamic Availability; Exergy, Loss of Work;	Ch. 9 of T1
31-33	Heat Exchanger Network Synthesis	Introduction to HEN Synthesis*	Ch.10 of T1 & Ch.8 of R1
34-37	Advanced HEN Synthesis	Advanced HEN Synthesis* Loops and Splits; Threshold problems*	Ch.10 of T1 & Ch.8 of R1
38-42	Heat & Power Integration	Data Extraction Heat Integration in Design	Ch.10 of T1 & Ch.8 of R1

***** Note: Telepresence classes with Prof. Gulyani Bharat Bhushan from Dubai Campus will be arranged

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Date & Time	Weightage (%)	Nature of Component
1.	Test-I	1hr	8/9, 8.30-9.30 AM	20	Closed Book
2.	Test-II	1hr	25/10, 8.30-9.30 AM	20	Open Book
3.	Comprehensive	3hrs.	12/12 AN	40	Closed Book/Open book
4.	Surprise tests/Assignments	Variable		20	Closed Book/Open book

Chamber Consultation Hour: Will be announced
Notices: All notices/announcements will be communicated through CMS.
Make-up Policy: Make-up is granted only for genuine cases with valid justification. A prior permission from the Instructor-in-charge is required.

Instructor-in-charge
CHE F314