

Subject: Process Modelling, Simulation and Optimization

CHE-454	Chemical	3CH	CHE-	Process	3CH
XXX	Modelling, Simulation and Optimization			Theory+Lab (3+1)	
Pre- req.	Nil			Category	Core Depth
Course Contents as per PEC Guidelines 2023-2024					
• Design & Simulation Software: Introduction to various designs and simulation software e.g., HYSYS, ChemCAD etc. • A review of capabilities and limitations of the design / simulation software. Flowsheets and sub-flowsheets. • Defining process streams and use of Fluid Packages • Adding common unit operations in the flow sheet. Drawing simple Process Flow Diagrams (PFD) in HYSYS, steady state material and energy balances using graphical user interface and worksheet. • Simulation of equipment from the following categories in Aspen HYSYS: Heat transfer, Separators, Pressure changers, Reactors • Economic analysis in simulation environment • Hierarchy of process design; Process synthesis and design strategy • Strategies for decision making. • Simulation of equipment from the following categories in Aspen HYSYS: ➤ Heat transfer ➤ Separators ➤ Pressure changes ➤ Reactors • Economic analysis in simulation environment • Importance and hierarchy of optimization: Significance of optimization in chemical engineering, Classification and model development, Solution and interpretation of optimization models, Economic and time value of objective functions • Linear programming application to chemical processes in multi-variant situations: Unconstrained functions with one-dimensional search, Nonlinear mixed integer optimization, Application of optimization in heat transfer and energy conservation. • Optimal design and operation of conventional mass transfer operations: Optimal design of fluid flow in pipes with and without pumping and compressing devices, Optimization of medium scale plants along with integrated planning and control in process industries					

Weekly plan/ Reference Books	
1	Design & Simulation Software: Introduction to various design and simulation software e.g., HYSYS, ChemCAD etc.
2-3	A review of capabilities and limitations of the design / simulation software. Flowsheets and sub-flowsheets.
4	Defining process streams and use of Fluid Packages
5	Adding common unit operations in the flow sheet. Drawing simple Process Flow
6	Diagrams (PFD) in HYSYS, steady state material and energy balances using graphical user interface and worksheet.
7-8	Simulation of equipment from the following categories in Aspen HYSYS: Heat transfer, Separators, Pressure changers, Reactors - Economic analysis in simulation environment - Hierarchy of process design; Process synthesis and design strategy - Strategies for decision making.
9-10	Mid Term Exams
11-12	Simulation of equipment from the following categories in Aspen HYSYS: - Heat transfer - Separators - Pressure changes - Reactors Economic analysis in simulation environment
13	Importance and hierarchy of optimization: Significance of optimization in chemical engineering, Classification and model development, Solution and interpretation of optimization models, Economic and time value of objective functions
14	Linear programming application to chemical processes in multi-variant situations: Unconstrained functions with one-dimensional search, Nonlinear mixed integer optimization, Application of optimization in heat transfer and energy conservation.
15-16	Optimal design and operation of conventional mass transfer operations: Optimal design of fluid flow in pipes with and without pumping and compressing devices, Optimization of medium scale plants along with integrated planning and control in process industries
17	Revision
18	End Semester Exam
TEXT AND REFERENCE BOOKS: - HYSYS (or Chem CAD) User and Tutorial Guides. - Chau,Pao C."Process Control: A First Course with MATLAB",Cambridge University Press,2002. - Davis, Timothy A. and Sigmon, Kermit,"MATLAB Primer,7th Ed."Chapman & Hall/CRC,2004. - Smith,R,"Chemical Process Design and Integration"2005,John Wiley & Sons.	

