The University of Jordan
School of Engineering
Chemical Engineering Department

Program: B.Sc.
Academic Year: (/)
Semester: _____

- **CHE 0905484: Process Modelling and Simulation**
- **Course Catalog (2024)**

Introduction to modelling and simulation, development, solution and analysis of model equations for batch and continuous systems at steady and unsteady state conditions, analysis of models: Basic concepts of analysis are illustrated through applications to typical chemical engineering problems, which include linear and nonlinear systems, Introduction to simulation methodologies and process flowsheet simulators.

Credit hours	**3**	**Level**	**4**	**Pre-requisite(s)**	**0905421, 0915441**
Instructor **Prof. Menwer Attarakih**		**Office number** **CHE258**		**Office phone** Ext. 22887	
Course website: https://elearning.ju.edu.jo/moodle10/ **Live Streaming Platform:** Microsoft Teams		**E-mail** **m.attarakih@ju.edu.jo**		**Place** Refer to Registration website	

- **Textbooks:**
  1. B. Wayne Bequette, 1998. Process Dynamics Modeling, Analysis, and Simulation. Prentice Hall PTR, Upper Saddle River, New Jersey.
  2. R. Turton, J. Shaeiwitz, D. Bhattacharyya, W. B. Whiting (2018). Analysis, synthesis and design of chemical processes, 5th Ed., Prentice Hall, PTR, New Jersey.
- **References:**
  1. Luyben, W. L., 1999. Process Modeling, Simulation, and Control for Chemical Engineers. McGraw-Hill Publisbing Company, New York.
  2. Thomas, P., 1999. Simulation of Industrial Processes for Control Engineers. Butterworth Heinmann, Oxford.
  3. Ramirez, W. F., 1998. Computational Methods in Process Simulation. Butterworth Heinmann, Oxford.
  4. Reklaitis, G. V. & Schneider, D. R. (1983): Introduction to material and energy balances, John Wiley & Sons, New York.
  5. CAPE OPEN TO CAPE OPEN Simulation Environment: http://www.cocosimulator.org/
- **Goals:**
  1. Be able to formulate, analyze and understand process models in chemical engineering with examples from reaction engineering, heat transfer and mass transfer operations.
  2. Be able to apply and use mathematical modelling tools for major problems that arise in chemical engineering which include principle formulation using fundamental laws and their classification into: Linear, nonlinear, lumped, distributed and dynamic versus steady state models.
  3. Be able to solve problems from chemical engineering which include systems of linear and nonlinear system of algebraic equations as well as systems of ordinary differential equations.
  4. Be able to deal with complete chemical process flowsheets without and with recycles using sequential and equation-oriented approaches.

- **Learning Objectives and Intended Learning Outcomes**

Topic	Students Outcomes
Topic 1: Introduction to process modeling (Weeks: 1-3) • Introduction to modelling and simulation: Basic concepts	O1

• Integral & differential balances • Analysis of models: Role of analysis, basic concepts of analysis, simple examples, source of model equations.	
Topic 2: Fundamentals of process modeling (Weeks: 4-6) • Conservation equations of mass, energy and momentum, constitutive equations, control volume concept, stability analysis, sensitivity analysis.	O1
Topic 3: Formulation of process models (Weeks: 7-10) • Development of model equations for simple isothermal non-reacting and reacting liquid systems for both steady state and unsteady state conditions.	O1
Topic 4: Two-phase flow modeling (Weeks: 11-12) • Isothermal two-phase systems and rate of mass transfer, equilibrium staged processes, non-isothermal systems. • Modelling of gas absorber, distillation column, heat exchanger, & heat transfer in a jacketed vessel.	O1
Topic 5: Dynamic analysis of linear & Nonlinear systems (Weeks: 13-14) • Stability, oscillations, saddle point, phase plane approach & simple bifurcation analysis.	O1
Topic 6: Chemical Process Simulation (Weeks: 15-16) • Introduction to simulation methodologies & process flowsheet simulators.	O7

▪ Evaluation

Evaluation Tool	Weight	Date
Midterm Exam	30	Will be announced by the department
Project with short exams	20	Will be arranged
Presentations	5	To be arranged one week after the assignment
Homework	5	Will be submitted one week after the assignment
Final Exam	40	Will be announced by the University

▪ Relationship to Program Outcomes (1-5)

New ABET 1 To 7	1	2	3	4	5	6	7
	X						X

▪ Relationship to CHE Program Objectives

PEO1	PEO2	PEO3	PEO4							
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▪ Document Control

Prepared by	Prof. Dr. Menwer Attarakih
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