Course E-Syllabus

1	**Course title**	Numerical Methods in Chemical Engineering
2	**Course number**	0935301
3	**Credit hours**	3
	Contact hours (theory, practical)	(3, 0)
4	**Prerequisites**	0915201, 0965201
5	**Program title**	B.Sc. in Chemical Engineering
6	**Program code**	5
7	**Awarding institution**	The University of Jordan
8	**School**	School of Engineering
9	**Department**	Department of Chemical Engineering
10	**Level of course**	Third year
12	**Final Qualification**	Bachelor's Degree
13	**Other department (s) involved in teaching the course**	No departments are involved in teaching the course
14	**Language of Instruction**	English
15	**Teaching methodology**	☐Blended ☐Online
16	**Electronic platform(s)**	**Course website: UJ E-learning** https://elearning.ju.edu.jo/login/index.php **Live Streaming Platform:** Microsoft Teams

17 Course Coordinator:

Name:Prof.
Office number: + 962 6 535 5000 ext. 22888
Email: @ju.edu.jo

18 Course Description:

Computers and error analysis, root finding, solution of linear and nonlinear system of equations, interpolation and curve fitting, numerical integration and differentiation and solution of ordinary differential equations. Single and system of ordinary differential equations. Solving initial value problems, introduction to numerical solution of partial differential equations. All methods are emphasized using algorithm development. Programming the main algorithms discussed in the course using available programming language tools.

19 Textbook and References:

A- **Textbook**:

1. Chapra, S.C., and Canale, R.P.,. (2009). Numerical Methods for Engineers. 6th edition. McGraw Hill.

B- **References**:

1. Hoffman, J.D., "Numerical Methods for Engineers and Scientists", McGraw-Hill (1992).
2. Gerald, C.F., and Wheatly, P.O., "Applied Numerical Analysis". 6th Ed., Addison Wesley, 1999.
3. Fausett, L.V., "Applied Numerical Analysis Using MATLAB", Prentice-Hall (1999).
4. Conte, S.D. and De Boor, C., "Elementary Numerical Analysis. An Algorithmic Approach". 3rd Ed., McGraw-Hill (1981).
5. Davis, M.E., "Numerical Methods and Modeling for Chemical Engineers", Wiley (1984).
6. Mathews, J.H., "Numerical Methods for Computer Science, Engineering and Mathematics",Prentice-Hall (1987).
7. Penny, J. and Lindfield, G., "Numerical Methods Using MATLAB", Ellis Horwood (1995).
8. Riggs, J.B., "An Introduction to Numerical Methods for Chemical Engineers" Texas Tech. University Press (1994).

20 Learning Objectives and Intended Learning Outcomes:

A- **Learning Objectives**:

1. Students will demonstrate the ability to apply numerical techniques to approximate solutionsof linear and nonlinear equations. [01]
2. Students will demonstrate the ability to apply numerical techniques to approximate areas under curves, as well as integrals and derivatives of functions of one variable. [01]
3. Students will demonstrate the ability to apply numerical techniques to approximate and interpolate function values. [01]
4. Students will demonstrate the ability to communicate advantages and disadvantages ofvarious numerical techniques and evaluate appropriateness of specific numerical methods forsolving linear and nonlinear system of mathematical problems. [01]
5. Students will demonstrate the ability to apply numerical techniques to approximate solutionsof ordinary differential equations and analyze the stability of these techniques. [01]
6. Students will demonstrate the ability to translate these numerical problems into computational algorithm using a high-level programming language such as EXCELL, MATLAB and POLYMATH. [01]

B- **Intended Learning Outcomes (ILOs)**:

Upon successful completion of this course, students will be able to:

1. Understanding of the role of computation as a tool in real-world problem solving.
2. Understanding of how computation is used to solve the most common mathematical problems frequently arising in engineering, science and technology.
3. Understanding of computational algorithms that are used to approximate numerical solutions of mathematical problems.
4. Apply knowledge of numerical techniques in their further study of advanced topics in mathematics as well as science and engineering.
5. Learn how to translate a variety of problems in traditional and emerging chemical engineering fields into numerical problems and how to tune numerical algorithms for effective and efficient solution.
6. Practice how to present computer input and output in a comprehensible, editable, and interpretableway.

21. Topic Outline and Schedule:

Week	Topic	Teaching Methods*/platform	Evaluation Methods**	References
1 and 2	Introduction to Numerical Methods	Synchronous lecturing/meeting	Homework	Chapra and Canale. (2009). Numerical Methods for Engineers. 6th edition. McGraw Hill
	Introduction to Numerical Methods	Synchronous lecturing/meeting	Homework	
	Introduction to Numerical Methods	Synchronous lecturing/meeting	Homework	
	Introduction to MATLAB	Synchronous lecturing/meeting	Quiz	
3 and 4	Numerical Solution of Single Nonlinear Equation	Synchronous lecturing/meeting	Homework	Chapra and Canale. (2009). Numerical Methods for Engineers. 6th edition. McGraw Hill
	Numerical Solution of Single Nonlinear Equation	Synchronous lecturing/meeting	Homework	
	Numerical Solution of System of Nonlinear Equations	Synchronous lecturing/meeting	Homework	
	Numerical Solution of System of Nonlinear Equations	Synchronous lecturing/meeting	Quiz	
5 and 6	Numerical Solution of System of Algebraic Equations	Synchronous lecturing/meeting	Homework	Chapra and Canale. (2009). Numerical Methods for Engineers. 6th edition. McGraw Hill
	Numerical Solution of System of Algebraic Equations	Synchronous lecturing/meeting	Homework	
	Numerical Solution of System of Algebraic Equations	Synchronous lecturing/meeting	Homework	
	Midterm Exam	In-lab lecture	Exam	
7 and 8	Interpolation	Synchronous lecturing/meeting	Homework	Chapra and Canale. (2009). Numerical Methods for Engineers. 6th edition. McGraw Hill
	Interpolation	Synchronous lecturing/meeting	Homework	
	Curve Fitting	Synchronous lecturing/meeting	Homework	
	Curve Fitting	Synchronous lecturing/meeting	Quiz	
9 and 10	Numerical Differentiation	Synchronous lecturing/meeting	Homework	Chapra and Canale. (2009). Numerical Methods for Engineers. 6th edition. McGraw Hill
	Numerical Differentiation	Synchronous lecturing/meeting	Homework	
	Numerical Integration	Synchronous lecturing/meeting	Homework	
	Numerical Integration	Synchronous lecturing/meeting	Quiz	
	Numerical Solution of Ordinary	Synchronous lecturing/meeting	Homework	

11 and 12	Differential Equations			Chapra and Canale. (2009). Numerical Methods for Engineers. 6th edition. McGraw Hill	
	Numerical Solution of Ordinary Differential Equations	Synchronous lecturing/meeting	Homework		
	Numerical Solution of Ordinary Differential Equations	Synchronous lecturing/meeting	Homework		
	Numerical Solution of Ordinary Differential Equations	Synchronous lecturing/meeting	Quiz		
13 and 14	Numerical Solution of Partial Differential Equations	Synchronous lecturing/meeting	Homework	Chapra and Canale. (2009). Numerical Methods for Engineers. 6th edition. McGraw Hill	
	Numerical Solution of Partial Differential Equations	Synchronous lecturing/meeting	Homework		
	Numerical Solution of Partial Differential Equations	Synchronous lecturing/meeting	Homework		
	Numerical Solution of Partial Differential Equations	Synchronous lecturing/meeting	Quiz		
15 and 16				Chapra and Canale. (2006). Numerical Methods for Engineers. 5th edition. McGraw Hill	
	Term Project	Synchronous lecturing/meeting	Term Project Presentations		
	Final Exam	Synchronous lecturing/meeting	Exam		

- Teaching methods include: Synchronous lecturing/meeting;
- Evaluation methods include: Homework, Quiz, Exam, project, …etc

23 Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Period (Week)	Platform
Quiz	5	1-5	In-Class and/or Microsoft teams
Midterm Exam	30	8	In-Class and/or Microsoft teams
Project	15	15	In-Class and/or Microsoft teams
Final Exam	50	16	In-Class and/or Microsoft teams

24 Course Requirements (e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc):

Students should have:

- Computer (with MATLAB software).
- Internet connection.
- Webcam
- Account on Microsoft Teams.

25 Course Policies:

A- Attendance policies:

- Students are expected to attend 100% of their lessons.
- Excused Absences are only allowed.
- Absence without explanation is subjected to university regulation.
- Substitution for absent students within the lab sections are not allowed.

B- Absences from exams and submitting assignments on time:

- Absences without written explanation are considered unexcused and subjected to university regulation.
- Late assignment submission is not allowed.

C- Health and safety procedures:

- Wearing **Masks** and **Gloves** is obligatory through the Lab.
- Studentsand instructors are subjected to the general health and safety conditions applicable at the university, under penalty of responsibility.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

- Cheating is not allowed and penalty is set out in university regulation.

E- Grading policy:

- 5% Quiz
- 30% Midterm Exam,
- 15 % Term Project,
- 50% Final Exam

F- Available university services that support achievement in the course:

- Computer Laboratory.

27 Additional information:

N/A

Name of Course Coordinator: Prof. **Signature: ----------**
Date: 24/9/2021

Head of Curriculum Committee/Department: ---------- **Signature: ----------**
Head of Department: Prof. **Signature: ----------**
Head of Curriculum Committee/Faculty:---------- **Signature: ----------**
Dean: Prof. **Signature: ----------**

Date 21-9-2025