

Course E-Syllabus

1	Course title	Mathematical Methods in Chemical Engineering
2	Course number	0915201
3	Credit hours	3
	Contact hours (theory, practical)	(3, 0)
4	Prerequisites	Calculus (3) (Math 0301201)
5	Program title	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	Second year
11	Year of study and semester (s)	2021/2022 First
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	<input checked="" type="checkbox"/> Blended <input type="checkbox"/> Online
16	Electronic platform(s)	Course website: UJ E-learning https://elearning.ju.edu.jo/login/index.php Live Streaming Platform: Microsoft teams

18 Course Coordinator:

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19 Course Descriptions:

This course introduces students to the formulation, methodology, and techniques for mathematical solution of chemical engineering interest. These methods can be used to solve problems in Fluid Flow, Heat and mass Transfer, Reaction Engineering and Thermodynamics. This course involves various engineering mathematical concepts with the focus on chemical engineering applications. The material covered in the course includes first, second and higher order ordinary differential equations, system of first order ordinary differential equations in addition to series solutions, Laplace transforms and Fourier analysis. By the end of the course solution of simple partial differential equations will be covered as well.

20 Textbook and References:

A- Textbook:

1. Kreyszig, E., (2009). Advanced Engineering Mathematics. 10thedition. John Wiley & Sons.

B- References:

1. Brannan, J.R. and Boyce, W.E., "Differential Equations: An Introduction to Modern Methods and Applications", John Wiley, 2007.
2. Hunt, B.R., Lipsman, R.L., Osborn, J.E., and Rosenberg, J.M., "Differential Equations With Matlab", 2nd edition, John Wiley, 2005.
3. Greenberg, M.D., "Advanced Engineering Mathematics", 2nd edition, Prentice Hall, Upper Saddle River, 1998.
4. Farlow, S.G., "An Introduction to Differential Equations and Their Applications", McGraw Hill, 1994.
5. Derrick, W.R. and Grossman, S.I., "Elementary Differential Equations with Applications", Wesley.
6. Boyce, W.E. and DiPrima, R.C., "Elementary Differential Equations and Boundary Value Problems", 5th edition, John Wiley, 1992.
7. R.K. Jain, S.R.K. Iyengar, "Advanced engineering mathematics", CRC Pr I Llc, 2002.
8. Thomas L. Harman, James Dabney, Norman Richert, "Advanced engineering mathematics using MAT-LAB V.4", 1997.
9. Dennis G. Zill, Michael R. Cullen, "Advanced engineering mathematics", 1992.
10. Glyn James, David Burley, and et al., "Advanced modern engineering mathematics", 1993.
11. C. Ray Wylie, Louis C. Barrett, "Advanced engineering mathematics", 6th-Edition, 1995.
12. Grant B. Gustafson, Calvin H. Wilcox, "Analytical and computational methods of advanced engineering mathematics", 1998.

21 Learning Objectives and Intended Learning Outcomes:**A- Learning Objectives:**

1. Translating given chemical engineering problems into a mathematical model. [01]
2. Solving a model by selecting and applying suitable mathematical methods. [01]
3. Understanding the meaning and the implications of the mathematical solution for the original problem. [01]

B- Intended Learning Outcomes (ILOs):

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

1. Demonstrate knowledge and understanding of the concepts, principles, solution approaches and operational techniques for the various topics covered in the course. [01]
2. Learn how to translate a variety of problems in traditional and emerging chemical engineering fields into mathematical problems and how to solve them analytically. [01]

22. Topic Outline and Schedule:

Week	Lecture	Topic	Teaching Methods*/platform	Evaluation Methods**	References
1	1.1	Review on mathematics and calculus	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	1.2	Concepts of Differential Equations	Synchronous lecturing/meeting	Homework	
	1.3	Concepts of Differential Equations	Synchronous lecturing/meeting	Homework	
2	2.1	First Order Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	2.2	Separable differential equations, Reduction to separable forms,	Synchronous lecturing/meeting	Homework	
	2.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
3	3.1	First Order Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	3.2	Exact differential equations, Integrating factors,	Synchronous lecturing/meeting	Homework	
	3.4	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
4	4.1	First Order Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	4.2	Linear differential equations, Reduction to linear form	Synchronous lecturing/meeting	Homework	
	4.3	Quiz 1	Synchronous lecturing/meeting	Quiz	
5	5.1	Second Order Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	5.2	Second Order D.E. reducible to the first order,	Synchronous lecturing/meeting	Homework	
	5.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
6	6.1	Second Order Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	6.2	Homogeneous Equations with constant coefficient and Euler-Cauchy Equation,	Synchronous lecturing/meeting	Homework	
	6.3	Applications to Chemical Engineering	Synchronous lecturing/meeting	Classwork	

		Problems			
7	7.1	Second Order Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	7.2	Nonhomogeneous Equations with constant coefficients and Euler-Cauchy equations and their solution by Undetermined Coefficients and by Variation of Parameters	Synchronous lecturing/meeting	Homework	
	7.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
8	8.1	Third Order Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	8.2	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
	8.3	Midterm Exam	Synchronous lecturing/meeting	Exam	
9	9.1	Third Order Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	9.2	Nonhomogeneous Equations with constant coefficients and Euler-Cauchy equations and their solution by Undetermined Coefficients and by Variation of Parameters	Synchronous lecturing/meeting	Homework	
	9.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
10	10.1	System of Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	10.2	Homogeneous Linear Systems with Constant Coefficients	Synchronous lecturing/meeting	Homework	
	10.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
11	11.1	System of Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	11.2	Nonhomogeneous Linear Systems and their solution by the Method of Undetermined Coefficients and the Method of Variation of Parameters	Synchronous lecturing/meeting	Homework	
	11.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	

12	12.1	Series Solution of Differential Equations	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	12.2	Power Series Method about an Ordinary Point, Frobenius Method about regular singular point)	Synchronous lecturing/meeting	Homework	
	12.3	Quiz 2	Synchronous lecturing/meeting	Quiz	
13	13.1	Laplace Transform	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	13.2	Transforms of Derivatives and Integrals, Differentiation and Integration of Transforms,	Synchronous lecturing/meeting	Homework	
	13.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
14	14.1	Laplace Transform	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	14.2	Linear D.E. with Constant Coefficients, Laplace Transforms inversion by Partial Fractions, System of D.E.	Synchronous lecturing/meeting	Homework	
	14.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	
15	15.1	Fourier Analysis	Synchronous lecturing/meeting	Homework	Kreyszig (2009). Advanced Engineering Mathematics. 10 th edition. John Wiley & Sons
	15.2	Introduction Partial Differential Equations	Synchronous lecturing/meeting	Homework	
	15.3	Applications to Chemical Engineering Problems	Synchronous lecturing/meeting	Classwork	

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- Teaching methods include: Synchronous lecturing/meeting; Asynchronous lecturing/meeting
- Evaluation methods include: Homework, Quiz, Exam, pre-lab quiz...etc

23 Evaluation Methods:

QF-AQAC-03.02.1.3

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

Evaluation Activity	Mark	Topic(s)	Period (Week)	Platform
Classwork & Homework	10	All topics	Through	In-Class and/or Microsoft teams
Quiz (1 & 2)	10	Ch 1 / Ch 4 & 5	4 / 12	Microsoft teams
Midterm Exam	30	Ch 1, 2 & 3	8	In-Class and/or Microsoft teams
Final Exam	50	All topics	16	In-Class and/or Microsoft teams

24 Course Requirements (e.g.: Students should have a computer, internet connection, webcam, and 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.

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 in the class.
- Students and 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:

- 10 % Classwork & Homework
- 10 % Quiz (1 & 2)
- 30 % Midterm Exam
- 50 % Final Exam

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

- Computer Laboratory.

26 Additional information:

N/A

Name of Course Coordinator: Prof. Naim M. Faqir

Signature: -----

Date: 24/9/2021

Head of Curriculum Committee/Department: -----

Signature: -----

Head of Department: Prof. Riyad Al-Shawabkeh

Signature: -----

Head of Curriculum Committee/Faculty:-----

Signature: -----

Dean: Prof. Naser Al-Huniti

Signature: -----