The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name:

Engineering Mathematics II

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Course Syllabus

1	**Course title**	Engineering Mathematics II
2	**Course number**	0331302
3	**Credit hours**	3
	Contact hours (theory, practical)	3
4	**Prerequisites/corequisites**	0301202
5	**Program title**	B.Sc.
6	**Program code**	
7	**Awarding institution**	The University of Jordan
8	**School**	Science
9	**Department**	Mathematics
10	**Course level**	College requirement
11	**Year of study and semester (s)**	all Semesters
12	**Other department (s) involved in teaching the course**	None
13	**Main teaching language**	English
14	**Delivery method**	☑Face to face learning☐Blended ☐Fully online
15	**Online platforms(s)**	☑Moodle ☑Microsoft Teams ☐Skype☐Zoom ☐Others……
16	**Issuing/Revision Date**	7.11.2022

17 Course Coordinator:

Name:Dr. Feras Yousef	Contact hours:9:30 – 10:30 (S/Tu/Th) 10:00 – 11:30 (M/W)
Office number:306	Phone number:22086
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18 Other instructors:

Name: Office number: Phone number: Email: Contact hours: Name: Office number: Phone number: Email: Contact hours:

19 Course Description:

Vector differential calculus, line and surface integrals, integral theorems, Fourier series, Fourier integrals, Fourier transforms, partial differential equations.

20 Course aims and outcomes:

A- Aims:

In this course, we teach three essential topics for engineering students. These topics are Advanced Calculus, Fourier Series and Fourier Integrals, and Partial Differential Equations. In chapter 9, we will review Vector Product, Curves: Circle, Ellipse, Straight Line, Helix, Plane Curves, Tangent to a Curve, and Gradient of a Scalar Field. Then we will cover the Divergence and Curl of a Vector Field. Also, we will talk about the importance of the Divergence and Curl of a Vector Field. In chapter 10, we start with the line integral of a vector field. The computation of the line integral over various types of paths will be given. Also, examples that show that line integral is path dependent is given. In case the line integral is path independent, the vector field is called conservative. It turns out that vector fields that are conservative are the ones that are a gradient of a scaler field. Students will be exposed to this material and investigate several examples that enhance their understanding. Also, students learn that a vector field is conservative if and only if its curl is equal to zero. One of the main tools in computing line integrals is Green's Theorem. Green's Theorem will be presented along with various examples that explain the importance of this theorem and how to apply it. Students study surfaces. They will look at two ways to represent surfaces. Important types of surfaces (such as: Planes, Cylinders, Paraboloid, Cones, an Spheres) will be presented. The study of surfaces is essential in computing surface integrals. Evaluating surface integrals (flux) over various types of surfaces will be given. One of the celebrated theorems in advanced calculus is the Divergence Theorem of Gauss. Student learn how to utilize the Divergence Theorem in computing the flux through a surface by computing the triple integral of the divergence of the vector field over the solid inside that surface. Student will see through examples that the use of the Divergence Theorem is a very powerful tool to evaluate the flux. Another famous theorem to compute the line integral in space is Stokes's Theorem. This Theorem is a generalization of Green's Theorem to space. Students learn how to apply this theorem to compute some of the line integrals in space.

The second topic of this course is Fourier Series and Fourier Integrals. This topic is given in chapter 11 of the book. The set of functions 1, cos(nx) and sin(nx) where n is a positive integer are orthogonal periodic functions. Students learn how to write a general periodic function in terms of these simple periodic functions. This will lead them to Fourier Series which is an infinite series of sines and cosines. Also, students learn about the convergence of this series. Fourier Series plays a very important role in solving Partial Differential Equations (such as wave equation, heat equation, and Laplace equation). For nonperiodic functions that are defined on R or R+, students will learn how to find Fourier integrals and Fourier Sine and Cosine integrals. Also, students learn how to evaluate Fourier Transform, Fourier Sine Transform and Fourier Cosine Transform.

The last topic of this course is Partial Differential Equations (PDEs). PDEs play an important role in modeling many real life problems. PDEs are very important in dynamics, elasticity, heat transfer, electromagnetic theory, and quantum mechanics. They have a much wider range of applications than ODEs, which can model only the simplest physical systems. The most important PDEs are the wave equation that can model the vibrating string and the vibrating membrane, the heat equation for temperature in a bar or wire, and the Laplace equation for electrostatic potentials in both cartesian and polar coordinates. Students learn how to derive the PDE that models the phenomena, such as the one-dimensional wave equation for a vibrating elastic string and the heat equation in a bar of length L. A very powerful technique of solving such PDEs is the separation of variables method. Students apply the separation of variables method to solve wave and heat equations in a finite string. Also, they use this method to solve Laplace equation over both a bounded plate and a disk. Students learn how to use Fourier Transform, Fourier Sine Transform and Fourier Cosine Transform to solve wave equation, heat equation, and Laplace equation over an infinite domain or a semi-infinite domain.

B- Students Learning Outcomes (SLOs):

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

SLOs / SLOs of the course	SLO (1)	SLO (2)	SLO (3)	SLO (4)	SLO (5)	SLO (6)	SLO (7)	SLO (8)
1) Evaluate and apply the gradient of a scalar function and the divergence and curl of a vector field.	●							
2)Evaluate line integrals and applying the path independence and exactness theorems.	●							
3) Understand Green's theorem in plane (Transformation between double and line integrals) and applying it to evaluate double and line integrals.	●						●	
4) Understand the divergence theorem of Gauss (Transformation between triple and surface integrals) and Stokes theorem (transformation between surface and line integrals) and applying them to evaluate related integrals.	●						●	
5)Construct the Fourier series and Fourier Sine and Cosine series to represent general periodic functions in terms of simple ones, namely, Cosines and Sines.		●						
6) Construct the Fourier, Fourier Cosine, and Fourier Sine integrals and transforms of non-periodic functions.		●						●
7)Using the Fourier series, integrals, and transforms, to solve different types of partial differential equations (Heat, Wave, Laplace, …).	●							●
8)Use the partial differential equations in various branches of mathematics, physics and engineering.	●				●			●

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21 . Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous/ Asynchronous Lecturing	Evaluation Methods	Resources
1	9.3	Vector Product	**1**	Face to Face	Moodle		Midterm	Text Book
	9.5	Curves: Circle, Ellipse, Straight Line, Helix, Plane Curves. Tangent to a Curve	**1**	Face to Face	Moodle		Midterm	Text Book
2	9.7	Gradient of a Scalar Field	**1**	Face to Face	Moodle		Midterm	Text Book
	9.8	Divergence of a Vector Field	**1**	Face to Face	Moodle		Midterm	Text Book
	9.9	Curl of a Vector Field	**1**	Face to Face	Moodle		Midterm	Text Book
3	10.1	Line Integrals	**1**	Face to Face	Moodle		Midterm	Text Book
	10.2	Path Independence of Line Integrals	**1**	Face to Face	Moodle		Midterm	Text Book
4	10.3	Double Integrals	**1**	Face to Face	Moodle		Midterm	Text Book
	10.4	Green's Theorem in the Plane	**1& 7**	Face to Face	Moodle		Midterm	Text Book
5	10.5	Surfaces for Surface Integrals	**1**	Face to Face	Moodle		Midterm	Text Book
	10.6	Surface Integrals	**1**	Face to Face	Moodle		Midterm	Text Book
6	10.7	Triple Integrals. Divergence Theorem of Gauss	**1& 7**	Face to Face	Moodle		Midterm	Text Book
7	10.9	Stokes's Theorem	**1& 7**	Face to Face	Moodle		Midterm	Text Book
8	11.1	Fourier Series	**2**	Face to Face	Moodle		Quiz	Text Book
9	11.2	Arbitrary Period. Even and Odd Functions. Half-Range Expansions	**2**	Face to Face	Moodle		Quiz	Text Book
10	11.7	Fourier Integral	**2 & 8**	Face to Face	Moodle		Quiz	Text Book
11	11.8	Fourier Cosine and Sine Transforms	**2 & 8**	Face to Face	Moodle		Quiz	Text Book

12	11.9	Fourier Transform	**2 & 8**	Face to Face	Moodle		Quiz	Text Book
	11.10	Tables of Transforms	**2**	Face to Face	Moodle		Quiz	Text Book
13	12.1	Basic Concepts of PDEs	**1**	Face to Face	Moodle		Quiz	Text Book
	12.2	Modeling: Vibrating String, Wave Equation	**8**	Face to Face	Moodle		Homework	Text Book
14	12.3	Solution by Separating Variables. Use of Fourier Series	**1 & 8**	Face to Face	Moodle		Homework	Text Book
	12.6	Heat Equation: Solution by Fourier Series. Steady Two-Dimensional Heat Problems. Dirichlet Problem	**1 & 8**	Face to Face	Moodle		Homework	Text Book
15	12.7 12.10	Heat Equation: Modeling Very Long Bars. Solution by Fourier Integrals and Transforms Laplace equation in Polar Coordinate	**2 & 5 & 8**	Face to Face	Moodle		Homework	Text Book

22 Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	SLOs	Period (Week)	Platform
Quiz	15		**1 & 2 & 8**		On Campus
Homework	5		**8**		On Campus
Midterm	30		**1 & 7**		On Campus
Final Exam	50		**1 & 2 & 5 & 7**		On Campus

23 Course Requirements

Each student must have:

- Account on Microsoft Teams

24 Course Policies:

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled time. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.

2. If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.

3. Medical certificates shall be given to the University Physician to be authorized by him. They should be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.

4. Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.

5. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on home works.

25 References:

A- Required book(s), assigned reading and audio-visuals:

Advanced Engineering Mathematics by E. Kreyszig, 10th Edition

B- Recommended books, materials,and media:

1) Advanced Engineering Mathematics by Dennis G. Zill and Warren S. Wright, 5th edition.

2) Advanced Engineering Mathematics by K. A. Stroud and Dexter J. Booth, 5th edition

26 Additional information:

- In order to succeed in this course, you need to be an active participant in learning – both in class and out of class.
- Class time will be spent on lecture as well as discussion of homework problems and some group work.
- To actively participate in class, you need to prepare by reading the textbook and doing all assigned homework before class (homework will be assigned each class period, to be discussed the following period).
- You should be prepared to discuss your homework (including presenting your solutions to the class) at each class meeting - your class participation grade will be determined by your participation in this.
- You are encouraged to work together with other students and to ask questions and seek help from the professor, both in and out of class.

Name of Course Coordinator**: Dr. Feras Yousef** Signature: ---------- Date: **7.11.2022**
Head of Curriculum Committee/Department: Prof. Ahmad Al Zghoul-- Signature: ----------
Head of Department: -Prof. Manal Ghanem - Signature: -M. Ghanem
Head of Curriculum Committee/Faculty: ---------- Signature: ----
Dean: Mahmoud Jaghoub Signature: ----------