جامعة الزيتونة الأردنية

Al-Zaytoonah University of Jordan

Course Syllabus

According to JORDAN National Qualification Framework (JNQF)

Course Name: Differential Geometry

Course Number: 0101433

General Course Information:

Course Title	Differential Geometry
Course Number	0101433
Credit Hours	3 credit hours
Education Type	Blended learning
Prerequisites/Co-requisites	Calculus (3)
Academic Program	Bachelor Program
Program Code	114
Faculty	Faculty of Science and IT
Department	Mathematics
Level of Course	3
Academic Year /Semester	2023/2024 1st Semester
Awarded Qualification	Bachelor
Other Department(s) Involved in Teaching the Course	-
Language of Instruction	English
Date of Production	2021-2022
Date of Revision	16-10-2023

Course Coordinator:

Coordinator's Name	NA
Office No.	
Office Phone Extension Number	
Office Hours	
E-mail	

Other Instructors:

Course Description *(English/Arabic)*:

English	This course concerns the Plane and space curves, Reparameterization by arc length, Curvature, Torsion, Frenet formulas, Osculating plane, normal plane, Rectifying plane, Bertrand curves, Surfaces in three dimensions, Smooth surfaces, The first fundamental form, length of curves on surfaces, Surface area, The Gauss map, The second fundamental form, Gauss formula, The normal and geodesic curvatures, Principal curvatures, Mean and Gauss curvatures, Geodesics and applications.
Arabic	يهتم هذا المساق بمنحنيات المستوى والفضاء، إعادة القياس بطول القوس، الانحناء، الالتواء، صيغ فرينيت، المستوى المتذبذب، المستوى العادي، المستوى التصحيحي، منحنيات برتراند، الأسطح في ثلاثة أبعاد، الأسطح الملساء، الشكل الأساسي الأول، أطوال المنحنيات على الأسطح، مساحة السطح ، خريطة غاوس، الشكل الأساسي الثاني، صيغة غاوس، الانحناءات العادية والجيوديسية، الانحناءات الرئيسية، الانحناءات المتوسطة والغاوسية، الجيوديسيا وتطبيقاتها.

Textbook: *Author(s), Title, Publisher, Edition, Year, Book website.*

1) Banchoff, T. and Lovett, S. (2010), Differential Geometry of Curves and Surfaces, USA, A. K. Peters, Ltd., Taylor and Francis Group, LLC.
2) O' Neill, B. (2006), Elementary Differential Geometry, 2nd edition,USA, Elsevier Inc.

References: *Author(s), Title, Publisher, Edition, Year, Book website.*

1. Pressely, A. (2010), Elementary Differential Geometry, 2nd edition, London, Springer – Verlage,Springer Undergraduate Mathematics Series.
2. Gray, A., Abbena,E. andSalamon, S.(2006), Modern Differential Geometry of Curves and Surfaces with Mathematica, 3rd edition, USA,Chapman & Hall/CRC, Studies in Advanced Mathematics, Boca Raton.
3. Kühnel, W. (2006),Differential Geometry, Curves-Surfaces-Manifolds,2nd edition, USA, AMS.

Course Educational Objectives (CEOs):

CEO1	Students should develop a strong understanding of smooth manifolds, which serve as the foundation for differential geometry. They should understand the definition, properties, and examples of smooth manifolds.
CEO2	Students should be able to define tangent spaces at points on a manifold and work with tangent vectors and vector fields on these spaces.
CEO3	Students should understand smooth functions on manifolds, as well as the algebraic structure of these functions and how to work with them.
CEO4	Students should learn about isometries, conformal mappings, and other geometric transformations and their properties.

Intended Learning Outcomes (ILO's):

Intended learning outcomes (ILOs)		Relationship to CEOs	Contribution to PLOs	Bloom Taxonomy Levels*	JNQF Descriptors**
K	Knowledge and Understanding				
ILO1-k	Introduce plane and space curves.	CEO1	PLO1 -K	Understanding	K
ILO2-k	Identify regular surfaces in three dimension, construct simple revolution surfaces, sphere, cylinder, ellipsoid…	CEO1+ CEO2+ CEO3	PLO1-K	Understanding	K
S					
ILO3-s	Perceive the difference between the Euclidean distance and the distance on a surface, the role of the first fundamental form.	CEO1	PLO7-s	Applying	S
C	Subject specific skills				
IL04-c	Cooperate to work effectively in the group assignments.	CEO3	PLO11-c	Applying	C

*Bloom Taxonomy Levels:

Level #	1	2	3	4	5	6
Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

** Descriptor (National Qualification Framework Descriptors): K: Knowledge, S: Skill, C: Competency.

Program Learning Outcome (PLOs):

	(PLOs)	JNQF Descriptors**		
		K	S	C
1.	Knowledge of the main concepts in pure mathematics.	√		
2.	Knowledge of the main concepts in applied mathematics.	√		
3.	Explain concepts, principles and theories in the fields of probability and statistics.	√		
4.	Possession of technological culture related to the fields of mathematics and its applications.	√		
5.	Making use of mathematical logic in practical life.		√	
6.	Engaging scientific methodology as a way of thinking and as a tool in facing problems.		√	
7.	Applying mathematical software packages in problem solving.		√	
8.	Being capable of data analysis.		√	
9.	Capability of teaching according to modern educational techniques.		√	
10.	Develop creative and innovative methods of teaching mathematics.		√	
11.	Showing the ability to work under ethical and professional standards within teams.			√
12.	Gaining critical thinking and scientific research skills.			√

**** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)**

Weekly Schedule *(please choose the type of teaching)*

- ☒ **Face to Face (F2F)**
- ☐ **Hybrid** *(One – To - One)*
- ☐ **Online**

Schedule of Simultaneous and their Topics:

Week	First Lecture (F2F)	Second Lecture (F2F)	ILOs	PLOs	JNQF Descriptors*
1	Plane and space curves	Plane and space curves	**ILO1-k**	**PLO2-k**	K
2	Reparametrization by arc length, Curvature and Torsion, Applications	Reparametrization by arc length, Curvature and Torsion, Applications	**ILO1-k**	**PLO2-k**	K
3	Frenet- Serret frame, Frenet-Serret Theorem.	Frenet- Serret frame, Frenet- Serret Theorem.	**ILO1-k**	PLO2-k	K
4	Osculating plane, Normal plane, Rectifying plane.	Osculating plane, Normal plane, Rectifying plane.	**ILO1-k**	PLO2-k	K
5	Involutes, Evolutes,	Involutes, Evolutes,	**ILO1-k**	PLO2-k	K

6	Bertrand curves, Spherical indicatrix.	Bertrand curves, Spherical indicatrix.	ILO2-k	PLO2-k	K
7	Global properties of curves, Simple closed curve.	Global properties of curves, Simple closed curve.	ILO2-k	PLO2-k	K
Midterm Exam (30%)					
9	Surfaces in three dimensions.	Surfaces in three dimensions.	ILO2-k	PLO2-k	K
10	The first fundamental form. Length of curves on surfaces	The first fundamental form. Length of curves on surfaces	ILO2-k ILO3-s	PLO2-k	K
11	Surface area. Propositions and examples.	Surface area. Propositions and examples.	ILO2-k ILO3-s	PLO2-k	K, S
12	The second fundament al form. Gaussian formula.	The second fundamental form. Gaussian formula.	ILO2-k	PLO2-k	K
13	The normal and geodesic curvature, Principal curvatures.	The normal and geodesic curvature, Principal curvatures.	ILO2-k	PLO2-k	K
14	Mean and Gauss's curvatures.	Mean and Gauss's curvatures.	ILO2-k	PLO2-k	K
15	**Projects Discussion**				
16	**Final Exam**				

* **K: Knowledge, S: Skills, C: Competency**

Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

- Lecture.
- learning through projects.
- learning through problem solving.

Course Policies:

A- Attendance policies:
The maximum allowed absences is 15% of the lectures.
B- Absences from exams and handing in assignments on time:
Midterm exam can be retaken based on approval of excuse by the instructor's discretion.
Not handing assignment on time will incur penalties.
C- Academic Health and safety procedures
D- Honesty policy regarding cheating, plagiarism, and misbehaviour:
Cheating, plagiarism, misbehaviour will result in zero grade and further disciplinary actions may be taken.
E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Online Activities (Course Videos, Discussion Forums, Quizzes) **20%**
- Midterm 30**%**
- Final Exam 50**%**

F- Available university services that support achievement in the course: **E-Learning Platform, Labs, Library.**

Required Equipment:

- PC / Laptop with webcam and mic
- Internet Connection
- Access to the ZUJ E-Learning Platform at https://exams.zuj.edu.jo/
- E-learning plan
- Satisfaction questionnaires for online and face-to-face learning
- Software for e-learning

Assessment Tools Implemented in the Course:

- Final Exam
- Midterm Exam
- Quizzes
- Homework
- Practice Labs
- Discussion Forums
- Improvement plans for online or face-to-face teaching.

Responsible Persons and their Signatures:

Course Coordinator		**Completed Date**	/ /
		Signature	

Received by (Department Head)		**Received Date**	/ /
		Signature	