Course Syllabus

According to JORDAN National Qualification Framework (JNQF)

Course Name: Advanced Calculus

Course Number: 0101202

General Course Information:

Course Title	Advanced Calculus
Course Number	0101202
Credit Hours	3 credit hours
Education Type	Traditional learning
Prerequisites/Co-requisites	Calculus (3) 0101201
Academic Program	Mathematics
Program Code	
Faculty	Faculty of Information Technology
Department	Mathematics
Level of Course	2
Academic Year /Semester	2023/2024 1st Semester
Awarded Qualification	BS'c
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	
Office No.	
Office Phone Extension Number	
Office Hours	
E-mail	

Other Instructors:

Instructor Name	
Office No.	
Office Phone Extension Number	
Office Hours	
Email	

Course Description *(English/Arabic)*:

English	This course is a continuous of the previous calculus courses and gives the students the concept of Vector-Valued Functions, Line and surface integrals, Jacobian determinant, Green's theorem, Curl and divergence of a vector field, Divergence theorem.
Arabic	هذا المساق هو تكملة لمساقات التفاضل السابقة التي تم تدريسها وهو يشمل المفاهيم، الدوال المتجهية, التكاملات الخطية والسطحية, محددة جاكوبي ,نظرية جرين, الالتفاف والتباعد للحقول المنجهية, نظرية التباعد.

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

Calculus, by Anton, Bivens and Davis, 12ᵗʰ Ed, 2021

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

1. Elementary Differential Equation and Boundary Value Problems, William Boyce & Richard C. Diprima, 10th edition, 2013. 2. Introduction to theory of Ordinary Differential Equations, V. hamrmaiah, 2013. 3. Ordinary Differential Equation, Purna Chandra, 2012.

Course Educational Objectives (CEOs):

CEO1	Demonstrate a deep understanding of advanced calculus concepts, including limits, continuity, differentiability, and integration
CEO2	Master advanced techniques of integration, including integration by parts, partial fractions, and other methods for solving integrals.
CEO3	Extends the concepts of calculus to functions of multiple variables. Topics include partial derivatives, gradients, multiple integrals, and the fundamental theorems for line and surface integrals

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	State the integration techniques to calculate multiple integrals in different coordinate systems.	CEO 3	PLO2-K	Remembering	K
ILO2-k	Memorize the different theorems of vector calculus.	CEO 2	PLO2-K	Understanding	K
S	Intellectual skills				
ILO3-s	Perform calculus operations on vector-valued functions.	CEO 2 CEO 3	PLO6-S	Applying	S
C	Subject specific skills				
ILO4-c	Use the most important theorems of vector calculus, such as the Fundamental Theorem of Line Integrals, Green's Theorem, the Divergence Theorem, and Stokes' Theorem, to simplify integration problems	CEO 2 CEO 3	PLO11-S	Applying	C
ILO5-c	Apply above mentioned concepts to a wide range of mathematical and physical problems	CEO 2 CEO 3	PLO11-S	Applying	C
D	Transferable skills:				
ILO6-d					

***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	Review of Vectors.	Parametric Equations of Lines, Vector Equation of Lines	ILO1-K	PLO1-K	K
2	Planes in 3-Space. Intersecting Planes .	Introduction to Vector-Valued Functions	ILO1-K	PLO1-K	K
3	Graphs of Vector-Valued Functions	Limits, Continuity, and Derivatives.	ILO2-S	PLO3-K	K

	Calculus of Vector-Valued Functions	Derivative Rules, Definite Integrals			
4	Antiderivatives of vector–valued functions	Curvature Motion along a curve (velocity, acceleration, and speed).	ILO3-S	PLO6-S	S
5	Directional derivative	The Gradient	ILO3-S	PLO6-S	S
6	Tangent Planes	Normal Vectors	ILO3-S	PLO6-S	S
7	Vector Fields	Divergence and Curl	ILO3-S	PLO6-S	S
Midterm Exam (30%)					
9	Line Integrals with Respect to Arc Length. Evaluating Line Integrals.	Line Integrals with Respect to x, y, and z.	ILO1-K	PLO2-K	K
10	Integrating a Vector Field Along a Curve. Work as a Line Integral	Line Integrals along Piecewise Smooth Curve	ILO3-S	PLO6-S	S
11	Independence of path. Conservative Vector Field	Test for Conservative Vector Fields. Green's Theorem	ILO3-S	PLO6-S	S
12	Green's Theorem for Multiply Connected Regions	Triple Integrals.	ILO3-S	PLO7-S	**S**
13	Volume Calculated as a triple integral	Triple Integrals in Cylindrical and Spherical Coordinates	ILO3-S	PLO6-S	S
14	Surface Integrals	Applications of Surface Integrals.	ILO3-S	PLO6-S	**S**
15	The Divergence Theorem, Stokes' Theorem	Relationship between Green Theorem and Stokes' The	ILO3-K	PLO6-S	S
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 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

Assessment Tools Implemented in the Course:

- Final Exam
- Midterm Exam
- Quizzes
- Homework

Responsible Persons and their Signatures:

Course Coordinator	Amer Dababneh	Completed Date	October 2023
		Signature	

Received by (Department Head)		Received Date	/ /
		Signature	