جامعة الزيتونة الأردنية

Al-Zaytoonah University of Jordan

Course Syllabus

According to JORDAN National Qualification Framework (JNQF)

Course Name: Linear Algebra (2)

Course Number: 0101322

General Course Information:

Course Title	Linear Algebra (2)
Course Number	0101322
Credit Hours	3 credit hours
Education Type	Blended learning
Prerequisites/Co-requisites	Linear Algebra (1)
Academic Program	Bachelor Program
Program Code	101
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	
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 completes the course linear algebra 1. It topics are: General vector space, Row space, Column space and Null space, Rank and nullity, Eigenvalues and eigenvectors, Similar matrices and diagonalization, Inner products, Inner products generated by matrices, Angle and orthogonality in inner product spaces, Orthonormal bases, Gram–Schmidt process, QR – decomposition, Diagonalization and quadratic forms, General linear transformations, Kernel and range, Inverse linear transformations
Arabic	فضاءات المتجهات العامة، فضاء الصف، فضاء العمود والفضاء الصفري، الرتبة والصفرية، القيم والمتجهات الذاتية، تشابه المصفوفات وعملية التحويل إلى الصيغة القطرية، الضرب الداخلي، الضرب الداخلي المتولد بواسطة المصفوفات،

	الزاوية والتعامدية في فضاءات الضرب الداخلي، القواعد المتعامدة معياريا، عملية جرام– شمث، تقسيم QR–، تحويل الصيغ التربيعية إلى الصيغ القطرية، التحويلات الخطية العامة، النواه والمدى، معكوس التحويلات الخطية.

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

Elementary Linear Algebra, by Howard Anton, 10th Edition 2019

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

1- "Linear Algebra and its Applications", by David C. Lay and Steven R. Lay and Judi J. McDonald, 5th Ed., (2015), Addison-Wesley.
2- "Elementary Linear Algebra", B. Kolman and D. Hill, 9th Ed., (2008), Pearson.
3- "Linear Algebra with Applications", Steven J. Leon, 9th Ed., (2015), Pearson.
4- "Linear Algebra; An introduction", by R. Larson, 8th Ed., (2017), Cengage.

Course Educational Objectives (CEOs):

CEO1	Develop a geometric understanding of linear transformations and their effect on vectors.
CEO2	Understand matrix factorization techniques like LU decomposition, QR decomposition, and singular value decomposition (SVD).
CEO3	Study inner product spaces, orthogonality, and the Gram-Schmidt process.

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	Recognize the notion of linear transformation.	CEO1	PLO1-k	Understanding	K
ILO2-k	Describe the different type of linear transformations.	CEO1	PLO2-k	Understanding	K
ILO3-k	Memorize the properties of inner product spaces.	CEO3	PLO1-k	Applying	K
ILO4-k	Recognize quadratic forms.	CEO1	PLO2-k	Understanding	K
S					
ILO5-s	Justify whether a matrix is triangular, diagonalizable, symmetric, and/or orthogonal	CEO2	PLO5-s	Evaluating	S
ILO6-s	Use the definition and properties of similar matrices	CEO2	PLO6-s	Applying	S
ILO7-s	Analyze whether a linear transformation is one-to-one or onto.	CEO1	PLO8-s	Analyzing	S
ILO8-s	Verify the Cauchy-Schwarz Inequality, the Triangle Inequality, and the Pythagorean Theorem	CEO3	PLO9-s	Analyzing	S
C					

ILO9-c	Work independently to solve assignments in the course.	CEO3	PLO11-c	Applying	C
ILO10-c	Cooperate to work effectively in the group assignments.	CEO2	PLO11-c	Applying	C
D	Transferable skills:				
ILO11-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)	Activity	ILOs	PLOs	JNQF Descriptor

					s*
1	Row space, Column space and Null space Consistency and the general solution of a linear system $AX=B$. Bases for the row space, column space and null space.	Activity: Background	2	1	K
2	Rank and nullity of a matrix. Relationship between rank and nullity(the dimension theorem)	Activity: Video 1 Solving exercises	2	5	K
3	II. Real Inner- Product Spaces Properties. Length and distance in an inner-product space.	Activity:Home work1: On the subjects studied on the first three weeks	5	8	S
4	Cauchy-Schwarz inequality. Triangle inequality. Angle between two vectors.	Activity: Quiz 1	7	6	S
5	Orthogonality. Orthogonal and orthonormal sets. GramSchmidt Process.	Activity: Assignment 1: On the rank and nullity.	7	7	S
6	Coordinates relative to orthonormal bases. QR – Decomposition of an m×n matrix.	Activity: Video 2	5	8	S
7	Orthogonal matrices. Change of bases and transition matrix.	Activity: Homework 2 On the subjects studied in the weeks 4,5 and 6	3	1	K
	Midterm Exam (30%)				
9	Bases for eigenspaces. Finding the eigenvalues of any positive integer power, the transpose and the inverse (if exists) of a square matrix.	Activity: Self-reading Procedure for diagonalizing a matrix. Relationship between having distinct eigenvalues and diagonalizability. Diagonalization and computing powers of a matrix.	6	7	S
10	Orthogonal diagonalization. Symmetric matrices and orthogonal diagonalizability.	Activity: Self-reading Finding linear transformations from images of bases vectors. Composition of linear transformations. Kernel and range of a L.T.	5	8	S

11	Rank and nullity of a L.T. Dimension theorem for L.Ts. One-to-one L. Ts and their inverse L.Ts.	Activity: Video3 Solving exercises	4	1	K
12	Matrices of general L.Ts. Similar matrices.	Activity: Homework 3: On the subjects studied after the midterm	6	7	S
13	Matrix representation of quadratic forms. Positive definite quadratic forms.	Activity: Self-reading	9	10	C
14	Diagonalization of quadratic forms.Quadratic forms and conic Sections. Quadratic forms and quadric Surfaces.	Activity: Quiz 2	10	12	C
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.
- flipped learning.
- 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, Practice labs, 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

Assessment Tools Implemented in the Course:

- Final Exam
- Midterm Exam
- Quizzes
- Homework

Responsible Persons and their Signatures:

Course Coordinator	Waseem Almashaleh	**Completed Date**	**Oct / 2023**
		Signature	

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