



مركز الاعتماد  
وضمان الجودة  
ACCREDITATION & QUALITY ASSURANCE CENTER



**The University of Jordan**

**Accreditation & Quality Assurance Center**

## **Course Syllabus**

**Course Name: Linear Algebra 2**

## Course Syllabus

1	Course title	<b>Linear Algebra 2</b>
2	Course number	0301441
3	Credit hours	3
	Contact hours (theory, practical)	3
4	Prerequisites/corequisites	0301241
5	Program title	B.Sc. Mathematics
6	Program code	
7	Awarding institution	The University of Jordan
8	School	Science
9	Department	Mathematics
10	Course level	Compulsory Specialization requirement
11	Year of study and semester (s)	3 <sup>rd</sup> or 4 <sup>th</sup> year, 1 <sup>st</sup> and 2 <sup>nd</sup> or summer semester
12	Other department (s) involved in teaching the course	None
13	Main teaching language	English
14	Delivery method	On Campus
15	Online platforms(s)	<input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom <input type="checkbox"/> Others.....
16	Issuing/Revision Date	10 <sup>th</sup> Oct, 2022

### 17 Course Coordinator:

Name: Prof. Emad Abuosba

Contact hours: 8:30 – 9:30 (Su, Tue, Thu)

Office number: 308

Phone number: 22088

Email: eabusba@ju.edu.jo

**18 Other instructors:**

Name:

Office number:

Phone number:

Email:

Contact hours:

Name:

Office number:

Phone number:

Email:

Contact hours:

**19 Course Description:**

As stated in the approved study plan.

Vector spaces; subspaces; quotient spaces; linear independence and bases; dual spaces; inner product spaces; orthonormal bases; linear transformations; eigenvalues, eigenvectors and determinants of linear transformations; matrix representation; change of basis and similarity; invariant subspaces; canonical forms of linear transformations; diagonal form; triangular form; nilpotent transformations; Jordan form; companion matrices; commutators; the trace functional and Jacobson's lemma; normal transformations and the spectral theorem.

## 20 Course aims and outcomes:

### A- Aims:

- 1- Engage students in sound mathematical thinking and reasoning. This should include students finding patterns, generalizing, and asking/answering relevant questions.
- 2- Provide a setting that prepares students to read and learn mathematics on their own.
- 3- Explore multiple representations of topics including graphical, symbolic, numerical, oral, and written. Encourage students to make connections among the various representations to gain a richer, more flexible understanding of each concept.
- 4- Analyse the structure of real-world problems and plan solution strategies. Solve the problems using appropriate tools.
- 5- Develop a mathematical vocabulary by expressing mathematical ideas orally and in writing.
- 6- Enhance and reinforce the student's understanding of concepts through the use of technology when appropriate.

### B- Students Learning Outcomes (SLOs):

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

SLOs	SLO (1)	SLO (2)	SLO (3)	SLO (4)	SLO (5)	SLO (6)	SLO (7)	SLO (8)
SLOs of the course								
1 Write and read proofs in linear algebra							•	
2 Find basis and dimension for vector spaces							•	
3 Find the kernel and range of a linear transform							•	
4 Find Jordan form for given matrices							•	
5 Make mathematical thinking and reasoning, find patterns, generalize, and ask/answer relevant questions							•	

## 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	1.1	Definition and properties of vector spaces	7	Face to Face	Moodle		Quiz	Text Book
	1.2	Subspaces	7	Face to Face	Moodle		Quiz	Text Book
	1.3	Subspaces	7	Face to Face	Moodle		Quiz	Text Book
2	2.1	Direct sums, Quotient spaces	7	Face to Face	Moodle		Quiz	Text Book
	2.2	Direct sums, Quotient spaces	7	Face to Face	Moodle		Quiz	Text Book
	2.3	<b>Exercises:</b> 3, 5, 8, 9, 10, 11, 13, 14, 15.	7	Face to Face	Moodle		Quiz	Text Book
3	3.1	Span, Linear independence	7	Face to Face	Moodle		Quiz	Text Book
	3.2	Span, Linear independence	7	Face to Face	Moodle		Quiz	Text Book
	3.3	Bases	7	Face to Face	Moodle		Quiz	Text Book
4	4.1	Bases, Dimension	7	Face to Face	Moodle		Quiz	
	4.2	Bases, Dimension	7	Face to Face	Moodle		Midterm	Text Book
	4.3	<b>Exercise:</b> 1, 2, 3, 8 – 14.	7	Face to Face	Moodle		Midterm	Text Book
5	5.1	Definitions of Linear transformation	7	Face to Face	Moodle		Midterm	Text Book
	5.2	Null space, Range	7	Face to Face	Moodle		Midterm	Text Book
	5.3	Null space, Range	7	Face to Face	Moodle		Midterm	Text Book
6	6.1	Matrix of linear transformation	7	Face to Face	Moodle		Midterm	Text Book
	6.2	Inevitability, Change of bases,	7	Face to Face	Moodle		Midterm	Text Book

		Similarity						
	6.3	<b>Exercises:</b> 5, 6, 7, 9, 10, 12, 13, 15, 19, 22, 23, 24.	7	Face to Face	Moodle		Midterm	Text Book
7	7.1	Eigenvalues and Eigenvectors	7	Face to Face	Moodle		Midterm	Text Book
	7.2	Eigenvalues and Eigenvectors	7	Face to Face	Moodle		Midterm	Text Book
	7.3	Invariant subspace,	7	Face to Face	Moodle		Midterm	Text Book
8	8.1	Triangular and Diagonal Matrices	7	Face to Face	Moodle		Midterm	
	8.2	Triangular and Diagonal Matrices	7	Face to Face	Moodle		Midterm	Text Book
	8.3	<b>Exercises:</b> 1 - 5, 10, 11, 14, 18, 19, 21.	7	Face to Face	Moodle		Midterm	Text Book
9	9.1	Inner Product	7	Face to Face	Moodle		Midterm	Text Book
	9.2	Norm, Orthonormal bases	7	Face to Face	Moodle		Midterm	Text Book
	9.3	Norm, Orthonormal bases	7	Face to Face	Moodle		Midterm	Text Book
10	10.1	Projection,	7	Face to Face	Moodle		Midterm	Text Book
	10.2	Adjoint Operators.	7	Face to Face	Moodle		Midterm	Text Book
	10.3	<b>Exercises:</b> 2, 4, 5, 6, 7, 10, 11, 13, 15, 17, 18, 27, 28, 29, 30, 31.	7	Face to Face	Moodle		Midterm	Text Book
11	11.1	<b>Midterm</b>	7	Face to Face	Moodle			Text Book
	11.2	Self Adjoint Operators	7	Face to Face	Moodle		Quiz	Text Book
	11.3	Normal Operators	7	Face to Face	Moodle		Quiz	Text Book
12	12.1	Spectral Theorem	7	Face to Face	Moodle		Quiz	Text Book
	12.2	Spectral Theorem	7	Face to Face	Moodle		Quiz	Text Book
	12.3	<b>Exercises:</b> 1, 2, 3, 4, 6.	7	Face to Face	Moodle		Quiz	Text Book
13	13.1	Generalized Eigenvector, Characteristic polynomial	7	Face to Face	Moodle		Quiz	Text Book
	13.2	Minimal polynomial,	7	Face to Face	Moodle		Quiz	Text Book

		Nilpotent transformation, Jordan form.						
	13.3	<b>Exercises:</b> 1, 2, 5, 6, 21, 22.	7	Face to Face	Moodle		Quiz	Text Book
14	14.1	Trace of Linear Transformation	7	Face to Face	Moodle		Homework	Text Book
	14.2	Trace of Linear Transformation	7	Face to Face	Moodle		Homework	Text Book
	14.3	Determinants of Linear transformation	7	Face to Face	Moodle		Homework	Text Book
15	15.1	Determinants of Linear transformation	7	Face to Face	Moodle		Homework	Text Book
	15.2	Determinants of Linear transformation	7	Face to Face	Moodle		Homework	Text Book
	15.3	<b>Exercises:</b> 1, 4, 7, 10, 12, 16, 18, 21, 24.	7	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 #1	10		7		On Campus
Quiz #2	10		7		On Campus
Homework	5		7		On Campus
Midterm	25		7		On Campus
Final Exam	50		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:

Linear Algebra Done Right by Sheldon Axler , 2<sup>nd</sup> Edition.

B- Recommended books, materials, and media:

- 1) P. Halmos, Finite Dimensional vector spaces.
- 2) N. Herstein, Topics in Algebra.
- 3) G. Strang, Linear Algebra and Application.





## 26 Additional information:

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Name of Course Coordinator: Prof. Emad Abuosba Signature: ----- Date: 10-10-2022
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: -----