Form: **Course Syllabus**	**Form Number**	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
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	Number of Pages	07

1.	**Course Title**	**Matrix Analysis**
2.	**Course Number**	0301721
3.	**Credit Hours (Theory, Practical)**	3
	Contact Hours (Theory, Practical)	3
4.	**Prerequisites/ Corequisites**	None
5.	**Program Title**	M.Sc.
6.	**Program Code**	
7.	**School/ Center**	Science
8.	**Department**	Mathematics
9.	**Course Level**	Obligatory for the non-thesis track
10.	**Year of Study and Semester (s)**	First year
11.	**Other Department(s) Involved in Teaching the Course**	None
12.	**Main Learning Language**	English
13.	**Learning Types**	■Face to face learning ☐Blended ☐Fully online
14.	**Online Platforms(s)**	■Moodle ☐Microsoft Teams
15.	**Issuing Date**	October 28, 2024
16.	**Revision Date**	

17. Course Coordinator:

Name: Prof. Fuad Kittaneh Contact hours: Monday and Wednesday 2:30-4:00

Office number: 210 Phone number: 22108

Email: fkitt@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. Similarity and canonical forms, special classes of matrices, the singular value decomposition, determinant and trace inequalities, the min-max principle, norms of vectors and matrices, the Lowner order of Hermitian matrices, Kronecker product of matrices.

20. Program Student Outcomes (SO's):

(To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. Read, analyze and write logical arguments to prove mathematical and statistical concepts and theorems.

3. Communicate with mathematical and statistical ideas clearly and consistently, in writing and verbally.

7. Work effectively within work teams and communicate scientific knowledge and results with peers and experts in the field.

8. Apply methodologies and ethics of scientific research in preparation of scientific research in mathematics field.

21. Course Intended Learning Outcomes (CLO's):

(Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. Investigate the similarity and the Jordan canonical forms of matrices.
2. Know a lot about various classes of matrices, including Hermitian matrices, unitary matrices, normal matrices, and positive semidefinite matrices.
3. Employ Schur's theorem and the spectral theorem for normal matrices in many aspects of matrix analysis.
4. Prove determinant inequalities for positive definite matrices.
5. Compute the singular value decomposition and the generalized inverses of matrices.
6. Establish matrix inequalities involving eigenvalues, singular values, traces, and the Lowner order of Hermitian matrices.
7. Be familiar with the basic facts and applications of the Kronecker products of matrices.

Course CLOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
1		x			x	
2	x	x		x		
3			x	x		x
4	x	x	x			
5		x	x		x	
6		x	x	x		x
7		x		x	x	

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program SO's / Course CLO's	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)	SO (6)	SO (7)	SO (8)
CLO (1)	x		x					
CLO (2)	x		x					
CLO (3)	x		x					x
CLO (4)	x		x					
CLO (5)	x		x					
CLO (6)	x		x				x	
CLO (7)	x		x				x	x

23. Topic Outline and Schedule:

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL) Fully Online (FO)	Platform Used	Synchronous (S) Asynchronous (A)	Evaluation Methods	Learning Resources
1	1.1	Similarity and canonical forms	1	FF		S	Home work 1	
	1.2	Similarity and canonical forms	1	FF		S	Home work 1	
2	2.1	Similarity and canonical forms	1	FF		S	Home work 1	
	2.2	Similarity and canonical forms	1	FF		S	Home work 1	
3	3.1	Special classes of matrices	2, 3	FF		S	First Exam	
	3.2	Special classes of matrices	2, 3	FF		S	First Exam	
4	4.1	Special classes of matrices	2, 3	FF		S	First Exam	
	4.2	Special classes of matrices	2, 3	FF		S	First Exam	
5	5.1	Determinant inequalities for positive definite matrices	3, 4	FF		S	Home work 2	
	5.2	Determinant inequalities for positive definite matrices	3, 4	FF		S	Home work 2	
6	6.1	Determinant inequalities for positive definite matrices	3, 4	FF		S	Home work 2	
	6.2	Determinant inequalities for positive definite matrices	3, 4	FF		S	Home work 2	
7	7.1	The singular value decomposition and the generalized inverses	2, 5	FF		S	Second Exam	
	7.2	The singular value decomposition and the generalized inverses	2, 5	FF		S	Second Exam	
8	8.1	The singular value decomposition and the generalized inverses	2, 5	FF		S	Second Exam	
	8.2	The singular value decomposition and the generalized inverses	2, 5	FF		S	Second Exam	
9	9.1	The min-max principle for eigenvalues and	3, 5	FF		S	Home work3	

		singular values						
	9.2	The min-max principle for eigenvalues and singular values	3, 5	FF		S	Home work3	
10	10.1	The min-max principle for eigenvalues and singular values	3, 5	FF		S	Home work 3	
	10.2	The min-max principle for eigenvalues and singular values	3, 5	FF		S	Home work 3	
11	11.1	The Lower order of Hermitian matrices	2, 6	FF		S	Home work 4	
	11.2	The Lower order of Hermitian matrices	2, 6	FF		S	Home work 4	
12	12.1	The Lower order of Hermitian matrices	2, 6	FF		S	Home work4	
	12.2	The Lower order of Hermitian matrices	2, 6	FF		S	Home work4	
13	13.1	Norms of vectors and matrices	3, 6	FF		S	Home work 5	
	13.2	Norms of vectors and matrices	3, 6	FF		S	Home work 5	
14	14.1	Norms of vectors and matrices	3, 6	FF		S	Home work 5	
	14.2	Norms of vectors and matrices	3, 6	FF		S	Home work 5	
15	15.1	Kronecker product of matrices	7	FF		S	Home work 5	
	15.2	Kronecker product of matrices	7	FF		S	Home work 5	
16							Final Exam	

24. Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	CLO/s Linked the Evaluation activity	Period (Week)	Platform
Course Work: Exam, Homework, Presentation	30		1-7	1-15	On Campus
Midterm Exam	30		4-7	8	On Campus
Final Exam	40		1-7		On Campus

25. Course Requirements:

(e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc.):

26. Course Policies:

1. The student is not allowed to take the course and its pre-requisite in the same time.
2. 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.
3. 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.
4. 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.
5. Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.
6. Solutions for the exams questions and marks will be announced to the students.
7. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on home works.

27. References:

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

1. R. Bellman, Introduction to Matrix Analysis, McGraw-Hill, New York, 1970.
2. R. Horn and C. Johnson, Matrix Analysis, Second Edition., Cambridge University Press, Cambridge, 2013.
3. M. Marcus and H. Minc, A Survey of Matrix Theory and Matrix Inequalities, Dover, New York, 1992.
4. D. Serre, Matrices: Theory and Applications, Springer-Verlag, New York, 2002.
5. G. Stewart and J. Sun, Matrix Perturbation Theory, Academic Press, New York, 1990.
6. F. Zhang, Matrix Theory, Second Edition, Springer-Verlag, New York, 2011.

B- Recommended books, materials, and media:

28. Additional information:

Name of the Instructor or the Course Coordinator: **Prof. Fuad Kittaneh**	Signature: ……	Date: 28/10/2024
Name of the Head of Quality Assurance Committee/ Department **Prof. Manal Ghanem**	Signature: ……	Date: ……
Name of the Head of Department **Prof. Baha Alzalg**	Signature: ……	Date: ……
Name of the Head of Quality Assurance Committee/ School of Science **Prof. Emad A. Abuosba**	Signature: ……	Date: ……
Name of the Dean or the Director **Prof. Mahmoud I. Jaghoub**	Signature: ……	Date: ……