مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name: Matrix Analysis

1	Course title	Matrix Analysis
2	Course number	0301921
3	Credit hours (theory, practical)	3
	Contact hours (theory, practical)	3
4	Prerequisites/corequisites	None
5	Program title	Ph.D.
6	Program code	
7	Awarding institution	The University of Jordan
8	Faculty	Science
9	Department	Mathematics
10	Level of course	Obligatory
11	Year of study and semester (s)	First year
12	Final Qualification	Ph.D. degree
13	Other department (s) involved in teaching the course	None
14	Language of Instruction	English
15	Date of production/revision	March 28, 2017

16. Course Coordinator:

Dr. Fuad Kittaneh

17. Other instructors:

18. Course Description:

Majorization, eigenvalue and singular value inequalities, unitarily invariant (or symmetric norms), spectral radius inequalities, numerical range, numerical radius inequalities, commutator estimates, arithmetic-geometric mean inequalities, Schwarz inequalities, perturbation of matrix functions.

19. Course aims and outcomes:

A- Aims:
This course aims at familiarizing the student with the advanced concepts, principles, and methods of matrix analysis and its applications to functional analysis, operator theory, numerical analysis, and mathematical physics.

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to …

1. Prove majorization relations and inequalities for eigenvalues, singular values, and unitarily invariant (or symmetric) norms of matrices.
2. Know the fundamental results about spectral radius, numerical range, and numerical radius.
3. Derive spectral radius, numerical radius, and norm inequalities for matrices.
4. Investigate various arithmetic-geometric mean inequalities and Schwarz inequalities for positive semidefinite matrices.
5. Understand the theory of commutators and establish commutator estimates.
6. Employ the theory of matrix monotone and matrix convex functions in perturbation inequalities for matrices.

20. Topic Outline and Schedule:

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
Majorization and unitarily invariant norms	1+2		1	Home work 1	
Spectral radius inequalities	3+4		2+3	First Exam	
Numerical range and numerical radius	5+6+7		2+3	Home Work 2	
Norm inequalities for positive semidefinite matrices	8+9		2+3	Second Exam	
Arithmetic-geometric mean and Schwarz inequalities	10+11		3+4	Presentation	
Commutators of matrices	12+13		3+4	Home Work 3	
Matrix monotone and matrix convex functions	14+15		5+6	Home Work 3	

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:
In order to succeed in this course, each student needs to be an active participant in learning – both in class and out of class.

- Class time will be spent on lecture as well as discussion of homework problems and some group work.
- To actively participate in class, you need to prepare by reading the textbook and doing all assigned homework before class (homework will be assigned each class period, to be discussed the following period).
- You should be prepared to discuss your homework (including presenting your solutions to the class) at each class meeting - your class participation grade will be determined by your participation in this.
- You are encouraged to work together with other students and to ask questions and seek help from the professor, both in and out of class.

22. Evaluation Methods and Course Requirements:

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

ILO/s	Learning Methods	Evaluation Methods	Related ILO/s to the program
	Lectures	Exam	
		Presentation	
		Homework	

23. 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 homeworks.

24. Required equipment:

25. References:

1. R. Bhatia, Matrix Analysis, Springer-Verlag, New York, 1997.
2. D. Bernstein, Matrix Mathematics, Princeton University Press, Princeton, 2009.
3. R. Horn and C. Johnson, Topics in Matrix Analysis, Cambridge University press, Cambridge, 1994.
4. X. Zhan, Matrix Inequalities, Springer-Verlag, New York, 2002.
5. X. Zhan, Matrix Theory, Amer. Math. Soc., Providence, 2013.
6. F. Zhang, Matrix Theory, Springer-Verlag, New York, 2011.
7. Selected Research Papers.

26. Additional information:

Name of Course Coordinator: Dr. Fuad Kittaneh Signature: ---------- Date: 28/03/2017

Head of curriculum committee/Department: ---------- Signature: ----------

Head of Department: ---------- Signature: ----------

Head of curriculum committee/Faculty: ---------- Signature: ----------

Dean: ---------- -Signature: ----------

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Head of Department
Assistant Dean for Quality Assurance
Course File