



مركز الاعتماد  
وإضمان الجودة  
ACCREDITATION & QUALITY ASSURANCE CENTER



**The University of Jordan**

**Accreditation & Quality Assurance Center**

## **Course Syllabus**

**Course Name: Operator Theory**

<b>1</b>	Course title	Operator Theory
<b>2</b>	Course number	0301912
<b>3</b>	Credit hours (theory, practical)	3
	Contact hours (theory, practical)	3
<b>4</b>	Prerequisites/corequisites	0301911
<b>5</b>	Program title	Ph.D.
<b>6</b>	Program code	
<b>7</b>	Awarding institution	The University of Jordan
<b>8</b>	Faculty	Science
<b>9</b>	Department	Mathematics
<b>10</b>	Level of course	Elective
<b>11</b>	Year of study and semester (s)	Second year
<b>12</b>	Final Qualification	Ph.D. degree
<b>13</b>	Other department (s) involved in teaching the course	None
<b>14</b>	Language of Instruction	English
<b>15</b>	Date of production/revision	March 28, 2017

**16. Course Coordinator:**

Dr. Fuad Kittaneh

**17. Other instructors:**

--

**18. Course Description:**

Basic facts about operators on Hilbert space, compact operators, Schatten p-classes, Hilbert-Schmidt operators, trace class operators, spectral theorem for normal operators, subnormal and hyponormal operators, shift operators, operator equations, commutators, derivations, norm inequalities for Hilbert space operators.

**19. Course aims and outcomes:****A- Aims:**

This course aims at familiarizing the students with the advanced concepts, principles, and methods of operator theory on Hilbert space and its applications to functional analysis, applied mathematics, and mathematical physics.

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

1. Know the basic results about operators on Hilbert space.
2. Know the basic theory of compact operators and the Schatten  $p$ -classes, with an emphasis on the Hilbert-Schmidt class and the trace class.
3. Be familiar with the spectral theorem for normal operators.
4. Investigate the classes of subnormal and hyponormal operators.
5. Derive examples in operator theory involving the unilateral shift operators.
6. Solve certain operator equations.
7. Prove results for commutators and derivations.
8. Prove operator norm inequalities for Hilbert space operators.

**20. Topic Outline and Schedule:**

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
Basic results about operators on Hilbert space	1+2		1	Home work 1	
Compact operators, Schatten $p$ -classes, Hilbert-Schmidt class, and trace class	3+4		1+2	First Exam	
The spectral theorem for normal operators	5+6		1+3	Home Work 2	
Subnormal and hyponormal operators	7+8		1+ 2+3	Second Exam	
Shift operators	9		4+5	Presentation	
Operator equations	10+11		6	Home Work 4	
Commutators and derivations	12+13		6+7	Home Work 5	
Norm inequalities for Hilbert space operators	14+15		7+8		

**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 home works.

**24. Required equipment:****25. References:**

1. J. B. Conway, A Course in Operator Theory, American Mathematical Society, Providence, RI, 2000.
2. P. R. Halmos, A Hilbert space problem Book, Second Edition, Springer=Verlag, New York, 1982.
3. B. Simon, Trace Ideals and Their Applications, Second Edition, American Mathematical Society, Providence, RI, 2005.

**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: -----

Copy to:  
Head of Department  
Assistant Dean for Quality Assurance  
Course File