



مركز الاعتماد  
وإضمان الجودة  
ACCREDITATION & QUALITY ASSURANCE CENTER



**The University of Jordan**

**Accreditation & Quality Assurance Center**

## **Course Syllabus**

### **CourseName**

0301911 Functional analysis

1	Course title	Functional Analysis
2	Course number	0301712
3	Credit hours (theory, practical)	3
	Contact hours (theory, practical)	3
4	Prerequisites/corequisites	711-Measure theory and Lebesgue integral
5	Programtitle	PhD. In Mathematics
6	Programcode	
7	Awarding institution	The University of Jordan
8	Faculty	Science
9	Department	Mathematics
10	Level of course	Compulsory specialization requirement
11	Year of study andsemester(s)	1 <sup>st</sup> year, 2 <sup>nd</sup> semester
12	Final Qualification	PhD. In Mathematics
13	Other department(s) involved in teaching the course	--
14	Language of Instruction	English
15	Date of production/revision	20/10/2020

**16. Course Coordinator:**

R. Khalil
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**17. Other instructors:**

Professor A. Talafha  
Prof. Yousef, A.

**18. Course Description:**

Normed spaces, Basics of Banach spaces, Basics of Hilbert spaces. Basics of linear operators on Hilbert and Banach spaces. The dual of a Banach spaces. The Riesz Representation Theorem. Sequence spaces and their duals. Examples of bounded linear operators on Banach and Hilbert spaces. The closed unit ball of Banach spaces. Closed convex sets in Banach spaces. Extreme points and exposed points of closed convex sets in Banach spaces. Closed operators and the closed graph theorem. Basic theorems in functional analysis

1.

## 2.19. Course aims and outcomes:

3.

**A- Aims:** to understand the concept of Banach spaces and Hilbert spaces and their duals. Further to understand the basics of bounded linear operators on Banach spaces

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

B1. To know the deep basic of Banach spaces

B2. To know different examples of Banach spaces

B3. To ask questions in basic functional analysis

B4. To know the geometry of the unit ball in Banach spaces

## 20. Topic Outline and Schedule:

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
4. Banach spaces	5.1	6.	7. B4	8. Homework	9. Krieger

6.Hilbert Spaces	10. 2	11.	B1	12. First exam	Kriesique
13. Linear operators	14. 3	15.	B1	16. Homework	Kreiseque
8.The geometry of the unit ball in Banach spaces	17. 4	18.	19. B1, B2	20. Second exam	Kriesique
21. Main theorems on bounded linear operators	22. 5-6	23.	24. B1, B3	25. Presentation 26. Second Exam	Rudin
27. Classes of operators on Hilbert spaces	28. 7	29.	30. B1, B4	31. Homework	32.Rudin

33. Riesz representation theorem	34. 8	35.	36. B1, B4	37. Presentation	Rudin
38. Classes of operators On Hilbert spaces	39. 9	40.	41. B1, B5	42. final	Taylor
43. closed operators	44. 10	45.	46. B1, B5	47. Homework	Taylor
48. Closed Graph theorem	49. 11	50.	51. B1, B5	52. Third Exam	Rudin
53. Extreme points and exposed points of unit balls	54. 12	55.	56. B1, B6	Homework	Rudin
57. Polar decomposition of some operators in Hilbert	58. 13	59.	60. B7	Homework	Rudin

spaces					
61. Application to optimization	62. 14	63.	64. B7	Homework	Krisique

### 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 at the webpage of the instructor:  
<http://eacademic.ju.edu.jo/eabuosba/default.aspx>
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:

Rudin, W. Functional analysis

Royden, real analysis

Krisneque. Introduction to functional analysis

#### 26. Additional information:

Name of Course Coordinator: Professor Khalil, R. Signature: -----R. Khalil----- Date: 29/3/2017

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

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

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

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



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Assistant Dean for Quality Assurance  
Course File