**The University of Jordan**

**Accreditation & Quality Assurance Center**

# Course Syllabus

# CourseName: Functional analysis

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|---|---|---|
| 1 | **Course title** | Functional Analysis |
| 2 | **Course number** | 0301911 |
| 3 | **Credit hours (theory, practical)** | 3 |
| | **Contact hours (theory, practical)** | 3 |
| 4 | **Prerequisites/corequisites** | Functional analysis Master |
| 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)** | 1st year, 2nd 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

**17.Other instructors**:

Prof. A.Talafha
Prof. F.Yousef

**18. Course Description:**

Theory of Banach spaces , Main theorems in Functional analysis: Hahn Banach Theorem, closed graph theorem, open mapping theorem, Uniform boundedness principle, and the KreinMilman Theorem. Spectral theory of bounded linear operators. Analysis of Compact operators

**19. Course aims and outcomes:**

**A- Aims:** to understand spectral theory of bounded linear operators and to know the structure of compact operators on Banach spaces

**B- Intended Learning Outcomes (ILOs):** Upon successfulcompletionofthiscoursestudentswillbeableto…

B1. To know the deep structure of Banach spaces B2. To know different structures of Banach spacesB3. To ask questions in functional analysis

B4. To classify operators compact or not

B5. To be able to classify operators according to thespectrum

**20. Topic Outline and Schedule:**

| Topic | Week | Instructor | Achieved ILOs | Evaluation Methods | Reference |
|---|---|---|---|---|---|
| 4.Banach spaces | 5.1 | 6. | 7.B4 | 8.Homework | 9.Rudin |
| 6.Bounded linear operators | 10. 2 | 11. | B1 | 12. First exam | Rudin |
| 13. Spectral theory | 14. 3 | 15. | B1 | 16. Home work | Rudin |
| 8.Spectral theory2 | 17. 4 | 18. | 19. B1, B2 | 20. Second exam | Rudin |
| 21. Compact operators | 22. 5-6 | 23. | 24. B1, B3 | 25. Presentation<br>26. SecondExam | Rudin |

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|---|---|---|---|---|---|
| 27. Compac t operators2 | 28. 7 | 29. | 30. B1, B4 | 31. Ho mew ork | 32.Rudin |
| 33. Applicat ions of spectral theory | 34. 8 | 35. | 36. B1, B4 | 37. Pr esentatio n | Conway |
| 38. Applicat ions of compact operators | 39. 9 | 40. | 41. B1, B5 | 42. fin al | Taylor |
| 43. Resolve nets of Operators | 44. 1 0 | 45. | 46. B1, B5 | 47. Ho mew ork | Taylor |
| 48. KrienMi lman Theorem | 49. 1 1 | 50. | 51. B1, B5 | 52. Th ird Exam | Foot &Dummit |
| 53. Extreme points | 54. 1 2 | 55. | 56. B1, B6 | Homework | Rudin |
| 57. Extrema of linear functional s | 58. 1 3 | 59. | 60. B7 | Homework | Rudin |
| 61. Applicat ion to optimization | 62. 1 4 | 63. | 64. B7 | Homework | Krisique |

## 21. Teaching Methods and Assignments:

Development of ILOs is promoted through thefollowing 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 homeworkbefore 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 methodsand 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:**

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**25. References:**

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| Rudin, W. Functional analysis |
| Helemberg, G. Spectral theory in Hilbert spaces |
| John Conway. A course in functional analysis |

**26. Additional information:**

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

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

Head of Department : Dr. Morad Ahmad Signature : ----------

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

Dean : Prof. Mahmoud AlJaghoub Signature : ----------

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