جامعة الزيتونة الأردنية
Al-Zaytoonah University of Jordan
كلية العلوم وتكنولوجيا المعلومات
Faculty of Science and information Technology

" عراقة وجودة"
"Tradition and Quality"

QF01/0408-4.0E	**Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Mathematics Department**

Study plan No.	2021/2022	University Specialization	**Bachelor of Mathematics**
Course No.	**0101452**	**Course name**	**Functional Analysis**
Credit Hours	**3**	**Prerequisite/ Co-requisite**	**Real Analysis (1)**

Course type	☐ MANDATORY UNIVERSITY REQUIREMENT	☐ UNIVERSITY ELECTIVE REQUIREMENTS	☐ FACULTY MANDATORY REQUIREMENT	☐ Support course family requirements	☐ Mandatory requirements	✓ Elective requirements
Teaching style	☐ Full online learning		✓ Blended learning		☐ Traditional learning	
Teaching model	☐ 1 Synchronous: 1 asynchronous		✓ 1 face to face : 1 asynchronous		☐2 Traditional	

Faculty member and study divisions' information (to be filled in each semester by the subject instructor)

Name	Academic rank	Office No.	Phone No.	E-mail

Division number	Time	Place	Number of students	Teaching style	Approved model

Brief description

Metric spaces, Normed linear spaces, Inner product spaces, Banach spaces, Hilbert spaces, Linear operators, Bounded and continuous linear operators on these spaces.

Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	1. E. Kreyszig, Introductory Functional Analysis with Applications, Wiley, New York, 1980. 2. A. Gmal and I. Jebril, Functional Analysis, King Faisal University, 2017.
Supportive learning resources (Books, databases, periodicals, software, applications, others)	1. J.B. Conway , A Course in Functional Analysis, 2nd ed., Springer-Verlag, New York, 1990. 2. Gohberg and S. Goldberg, Basic Operator Theory, Birkhauser, Boston, 1981. 3. A.E. Taylor and D.C. Lay, Introduction to Functional Analysis, 2nd ed., Wiley, New York, 1980.
Supporting websites	• http://www.freebookcentre.net/Mathematics/Functional-Analysis-Books.html
The physical environment for teaching	✓ Class room ☐ labs ✓ Virtual educational platform ☐ Others
Necessary equipment and software	
Supporting people with special needs	
For technical support	

Course learning outcomes (S= *Skills, C= Competences K= Knowledge,*)

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No.	Course learning outcomes	The associated program learning output code
Knowledge		
K1	Understand the basic facts about metric space, normed linear spaces and inner product spaces.	**MK 1**
K2	Know the basic concepts of Banach spaces and Hilbert spaces	**MK 2**
Skills		
S1	Students will be able to know the relation between metric space, normed space, and inner product spaces.	**MS 2**
S2	Know the basic facts about bounded linear functionals and bounded linear operators.	**MS 2**
Competences		
C1	Cooperate to work effectively in the group assignments.	**MC 1**
C2	Be able to think in mathematical analysis.	**MC 2**

Mechanisms for direct evaluation of learning outcomes

Type of assessment / learning style	Fully electronic learning	Blended learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
Midterm exam	30%	**30%**	40%	30%
Participation / practical applications	0	**0**	10%	30%
Asynchronous interactive activities	30%	**30%**	0	0
Final exam	40%	**40%**	50%	40%

Schedule of simultaneous / face-to-face encounters and their topics

Week	Subject	learning style	Reference
1	Metric spaces	Lecture	1-8
2	Further example of metric spaces	Lecture	9-16
3	Open set, closed set and neighborhood in metric space	Lecture	17-24
4	Convergence sequence in metric space Cauchy sequence in metric space	Lecture	25-31
5	Complete metric space	Lecture	32-40
6	Normed space, Banach space	Lecture	49-66
7	Further properties of normed spaces **Midterm exam**	Lecture	67-71
8	Linear operators, Bounded linear operators	Lecture	72-89
9	Continuous linear operators, Linear functionals	Lecture	90-111
10	Inner product space	Lecture	127-130
11	Example of Inner product space	Lecture	131-136
12	Further properties of inner products spaces	Lecture	130-141
13	Orthonormal	Lecture	142-151
14	Zorn's Lemma	Lecture	210-212
15	Hahn-Banach Theorem	Lecture	213-212

| 16 | Final Exam | | |

Schedule of asynchronous interactive activities (in the case of e-learning and blended learning)

Week	Task / activity	Reference	Expected results
1	Background	Real Analysis 1	Self-reading and Discussion
2	Self-reading	Examples of not metric space	Talk
3	Home work1: On the subjects studied on the first three weeks	(Lecture notes and Ref.1)	Submit a pdf or word sheet
4	Quiz 1	On the subjects studied on the first three weeks	Submitting on the E-learning
5	Assignment 1	Internet sources and the other Supportive learning resources	Presentation
6	Video 1	Solving exercises	Discussion in the class
7	Home work 2 On the subjects studied in the weeks 4,5 and 6	(Lecture notes and Ref.1)	Submit a pdf or word sheet
8	Assignment 2	Internet sources and the other Supportive learning resources	Submitted with the mid exam
9	Self-reading for selected topic	(Ref.2)	Talk
10	Video3 Solving exercises	E-learning	Discussion in the class
11	Home work 3: On the subjects studied after the Midterm exam	(Lecture notes and Ref.1)	Submit a pdf or word sheet
12	Self-reading	Examples of not normed space	Talk
13	Quiz 2	On the subjects studied on the subject studied after midexam	Submitting on the E-learning
14	Presentation of the selected subject	Internet sources and the reference book	Video
15	Video 4 Revision of all the course	E-learning	
16	**Final Exam**	-	