جامعة الزيتونة الأردنية

Al-Zaytoonah University of Jordan

Course Syllabus

According to JORDAN National Qualification Framework (JNQF)

Course Name: Real Analysis (1)

Course Number: 0101251

General Course Information:

Course Title	Real Analysis (1)
Course Number	0101251
Credit Hours	3 credit hours
Education Type	Blended learning
Prerequisites/Co-requisites	Non
Academic Program	Mathematics
Program Code	114
Faculty	Faculty of Information Technology
Department	Mathematics
Level of Course	4
Academic Year /Semester	2023/2024 1st Semester
Awarded Qualification	BS'c
Other Department(s) Involved in Teaching the Course	-
Language of Instruction	English
Date of Production	2021-2022
Date of Revision	October 2023

Course Coordinator:

Coordinator's Name	Dr. Haitham Qawaqneh
Office No.	229
Office Phone Extension Number	317
Office Hours	11-12:30 Sunday-Wednesday
E-mail	h.alqawaqneh@zuj.edu.jo

Other Instructors:

Instructor Name	NA
Office No.	
Office Phone Extension Number	
Office Hours	
Email	

Course Description *(English/Arabic)*:

English	*This course introduces a good knowledge of the Properties of real numbers, Inequalities, Completeness properties of R, Suprema and infima, Sequences of real numbers, Subsequences, Continuous functions, Uniform continuity, Lipchitz functions, Open and closed sets, Compact sets, Heine-Borel theorem*
Arabic	يعرض هذا المقرر معرفة جيدة بخصائص الأعداد الحقيقية، والمعادلات، وخصائص اكتمال مجموعة الأعداد الحقيقية، وأعظم الحدود وأدنى الحدود، وتتالي الأعداد الحقيقية، والتتاليات الفرعية، والدوال المستمرة، والاستمرارية الموحدة، والدوال ليبشيتز، والمجموعات المفتوحة والمغلقة، والمجموعات المدمجة، ومبرهنة هاينه-بوريل.

Textbook: *Author(s), Title, Publisher, Edition, Year, Book website.*

Jiří Lebl, Introduction to Real Analysis. Creative Commons Attribution-Noncommercial-Share Alike 4.0 International License, 1st Edition, 2023.

References: *Author(s), Title, Publisher, Edition, Year, Book website.*

1. Introduction to Real Analysis. By: William F. Trench, 1st Edition, Trinity University, 2022.
2. Real Analysis. By: Gary Towsley, Milne Library, 2021
3. Introduction to Proof in Analysis. By: Steve Halperin. Elizabeth Hughes, 2020.
4. Introduction to Real Analysis". By: R. Bartle and D. Sherbert. John Wiley & Sons, Third Edition **(2000).**

Course Educational Objectives (CEOs):

CEO1	Students will be proving basic set theoretic statements and emphasize the proofs' development.
CEO2	Students will be knowing of basic properties of the field of real numbers.
CEO3	Students will be understanding of the limit of a sequence and a function and the Cauchy criterion.
CEO4	Students will be understanding of continuity of a real-valued function.

Intended Learning Outcomes (ILO's):

Intended learning outcomes (ILOs)		Relationship to CEOs	Contribution to PLOs	Bloom Taxonomy Levels*	JNQF Descriptors**
K	Knowledge and Understanding				
1. ILO1-k	Students will be understanding list the basic properties of real numbers	CEO1	PLO1-k	Remembering	k
2. ILO2-k	Students will be understanding recognize the basic topological properties of the real numbers	CEO1	PLO1-k	Understanding	K
3. ILO3-k	Students will be understanding describe the properties of the continuous function	CEO2	PLO5-s	Understanding	K
4. ILO4-k	Students will be understanding define convergence and limit of sequences	CEO3, CEO4	PLO5-k	Analysing	K
5. ILO5-k	Students will be understanding explain the fundamental theorems of real analysis	CEO3, CEO4	PLO5-k	Applying	K
S	Intellectual skills				
6. ILO6-s	Students will be understanding compute all types of indeterminate forms of limits.	CEO2	PLO6-s	Applying	S
7. ILO7-s	Students will be understanding characterize the convergence of the sequences	CEO2	PLO6-s	Analysing	S
8. ILO8-s	Find the Taylor's series for a given expansion.	CEO3	PLO6-s	Applying	S

9. ILO9-s	Students will be understanding analyse functions of one variable.	CEO4	PLO9-s	Analysing	S
C	Subject specific skills				
10. ILO10-c	Students will be understanding use real analysis to solve various problems in all branches of mathematics.	CEO4	PLO10-c	Applying, Evaluating	C
D	Transferable skills:				

***Bloom Taxonomy Levels:**						
Level #	1	2	3	4	5	6
Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

**** Descriptor (National Qualification Framework Descriptors): K: Knowledge, S: Skill, C: Competency.**

Program Learning Outcome (PLOs):

	(PLOs)	JNQF Descriptors**		
		K	S	C
1.	Knowledge of the main concepts in pure mathematics.	√		
2.	Knowledge of the main concepts in applied mathematics.	√		
3.	Explain concepts, principles and theories in the fields of probability and statistics.	√		
4.	Possession of technological culture related to the fields of mathematics and its applications.	√		
5.	Making use of mathematical logic in practical life.		√	
6.	Engaging scientific methodology as a way of thinking and as a tool in facing problems.		√	
7.	Applying mathematical software packages in problem solving.		√	
8.	Being capable of data analysis.		√	
9.	Capability of teaching according to modern educational techniques.		√	
10.	Develop creative and innovative methods of teaching mathematics.		√	
11.	Showing the ability to work under ethical and professional standards within teams.			√
12.	Gaining critical thinking and scientific research skills.			√

**** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)**

Weekly Schedule *(please choose the type of teaching)*

- ☐ **Face to Face (F2F)**
- ☒ **Hybrid** *(One – To - One)*
- ☐ **Online**

Schedule of Simultaneous and their Topics:

Week	First Lecture (F2F)	Activity	ILOs	PLOs	JNQF Descriptors*

1	The Algebraic and the Order Properties of **R**	Activity: Solving suggested exercises and proving some suggested theories	ILO1-k	PLO1-k	K
2	Absolute Value and the Real Line	Activity: Solving suggested exercises	ILO1-k	PLO1-k	K
3	Applications of the Supremum Property	Activity: Proving some suggested theories	ILO2-k	PLO1-k	K
4	Sequences of Real Numbers.	Activity: Solving suggested exercises. Read suggest link	ILO6-s	PLO6-s	S
5	Some topology of R	Activity: Solving suggested exercises. Read suggest link	ILO6-s	PLO5-s PLO6-s	S
6	The Limit of a Sequence	Activity: Solving suggested exercises.	ILO7-s	PLO6-s PLO7-s	S
7	The Ratio Test for Convergence	Activity: Solving suggested exercises.	ILO9-s	PLO6-s PLO7-s	S
Midterm Exam (30%)					
9	Subsequences	Activity: Solving suggested exercises. Read suggest link	ILO6-s, ILO7-s	PLO6-s PLO7-s	S
10	The Cauchy Criterion	Activity: Solving suggested exercises. Read suggest link	ILO8-s	PLO6-s	S
11	Sequential Criteria for Limits	Activity: Solving suggested exercises	ILO8-s	PLO6-s	S
12	Some Extensions of the Limit Concept	Activity: Solving suggested exercises	ILO8-s	PLO5-s PLO6-s	S
13	Continuous Functions	Activity: Solving suggested exercises	ILO9-s	PLO6-s	S
14	Bolzano's Theorem; Uniform Continuity.	Activity: Solving suggested exercises and proving some suggested theories	ILO10-c	PLO6-s	C
15	**Projects Discussion**				
16	**Final Exam**				

* **K: Knowledge, S: Skills, C: Competency**

Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

- Lecture.
- learning through projects.
- learning through problem solving.

Course Policies:

A- Attendance policies:
The maximum allowed absences is 15% of the lectures.
B- Absences from exams and handing in assignments on time:
Midterm exam can be retaken based on approval of excuse by the instructor's discretion.
Not handing assignment on time will incur penalties.
C- Academic Health and safety procedures
D- Honesty policy regarding cheating, plagiarism, and misbehaviour:
Cheating, plagiarism, misbehaviour will result in zero grade and further disciplinary actions may be taken.
E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Online Activities (Course Videos, Practice labs, Discussion Forums, Quizzes) **20%**
- Midterm 30**%**
- Final Exam 50**%**

F- Available university services that support achievement in the course: **E-Learning Platform, Labs, Library.**

Required Equipment:

- PC / Laptop with webcam and mic
- Internet Connection
- Access to the ZUJ E-Learning Platform at https://exams.zuj.edu.jo/
- E-learning plan
- Satisfaction questionnaires for online and face-to-face learning
- Software for e-learning

Assessment Tools Implemented in the Course:

- Final Exam
- Midterm Exam
- Quizzes
- Homework

Responsible Persons and their Signatures:

Course Coordinator	Haitham Qawaqneh	**Completed Date**	**October 2023**
		Signature	

Received by (Department Head)		**Received Date**	/ /
		Signature	