



Course Specifications

Course Title:	Introduction to Real Analysis
Course Code:	30112101-3
Program:	BSc. Mathematics
Department:	Mathematical Science
College:	Applied Sciences
Institution:	Umm Al-Qura University

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A. Course Identification

1. Credit hours:	3 hours
2. Course type	
a.	University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b.	Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
3. Level/year at which this course is offered:	Level 4 / 2 nd year
4. Pre-requisites for this course (if any):	Calculus(2) 30112501-4
5. Co-requisites for this course (if any):	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3 Hours / Week	100%
2	Blended	0	0 %
3	E-learning	0	0 %
4	Correspondence	0	0 %
5	Other	0	0 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	(3 hours)x(15 week)
2	Laboratory/Studio	0
3	Tutorial	(3 hours)x(15 week)
4	Others (specify)	0
	Total	90 Hours
Other Learning Hours*		
1	Study	(1 hours)x(15 week)
2	Assignments	(1 hours)x(15 week)
3	Library	(1 hours)x(15 week)
4	Projects/Research Essays/Theses	(1 hours)x(15 week)
5	Others (specify)	0
	Total	60 Hours

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is intended to familiarize the students with the basic concepts, principles and methods of real analysis and its applications. It will cover algebraic and order properties of the real numbers, the least upper bound axiom, Archimedean property and its applications. Sequences and series of numbers will then be discussed, and theorems presented to analyze their convergence properties.

2. Course Main Objective

Students will demonstrate the ability to use rigorous mathematical thought processes in the following areas: real numbers, limits of functions, sequences and series.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge:	
1.1	Outline basic properties of the real number system	
1.2	Define supremum and infimum of a nonempty set	
1.3	Recall concept of limits	
1.4	Identify main properties of sequences	
1.5	Recognize different convergence tests of numerical series	
2	Skills :	
2.1	Prove uncountability of the real number system	
2.2	Interpret limit of a function in terms of limits of sequences	
2.3	Apply Cauchy criterion of Series	
3	Competence:	
3.1	Appraise the real number system as a “complete ordered field”	
3.2	Use graphical information and symbolic expression simultaneously in solving problems.	
3.3	Justify the choice of different steps in problem resolution procedure.	

C. Course Content

No	List of Topics	Contact Hours
1	Real numbers: <ul style="list-style-type: none"> The Algebraic properties of \mathbb{R}. Applications. The Order properties of \mathbb{R}. The absolute Value Proof by Induction. 	9
2	The completeness property of \mathbb{R} The Archimedean principle in \mathbb{R}	6
3	Real Sequences: <ul style="list-style-type: none"> Limit of a sequence Applications Convergent sequence 	9
4	<ul style="list-style-type: none"> Monotone and Bounded sequences. Applications. Subsequences and Cauchy Sequences. 	9

	<ul style="list-style-type: none"> Bolzano-Weierstrass Theorem 	
5	Numerical Series: <ul style="list-style-type: none"> Definition, convergent numerical series. Prove Cauchy's convergence criteria. Nature of convergence of numerical series using the comparison test, integral test, ratio test and Raabe's test... 	12
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	Outline basic properties of the real number system	Lectures Tutorials Discussion Quizzes	Exams Tutorials Quizzes group project
1.2	Define supremum and infimum of a nonempty set		
1.3	Recall concept of limits		
1.4	Identify main properties of sequences		
1.5	Recognize different convergence tests of numerical series		
2.0	Skills		
2.1	Prove uncountability of the real number system	Tutorials Discussion Quizzes	Exams Tutorials Quizzes group project
2.2	Interpret limit of a function in terms of limits of sequences		
2.3	Apply Cauchy criterion of Series		
3.0	Competence		
3.1	Appraise the real number system as a "complete ordered field"	Tutorials Discussion Quizzes	Exams (Midterm and Final). Homework
3.2	Use graphical information and symbolic expression simultaneously in solving problems.		
3.3	Justify the choice of different steps in problem resolution procedure.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Test (1)	6 th week	20%
2	Midterm Test (2)	12 th week	20%
3	Homework and Quizzes	During the semester	10%
4	Final Examination	End of semester	50%

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Each group of students is assigned to a faculty member where he or she will provide academic advising. All faculty members are required to be in their offices outside teaching hours. Each faculty member allocates at least 4 hours per week to give academic advice and to answer to the questions of students about concepts studied during the lectures.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Bartle and Sherbert: Introduction to Real Analysis, 4th edition, (2011). ISBN: 978-0-471-43331- 6
Essential References Materials	- An introduction to classical real analysis, (Karl, R. Stromberg) - Real and Complex analysis, (Walter Rudin)
Electronic Materials	http://ebookey.org/
Other Learning Materials	Microsoft Word

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Large classrooms that can accommodate more than 50 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment.	Students	Direct
Quality of learning resources.	Students	Direct
Extent of achievement of course learning outcomes.	Faculty member	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Council of Mathematics Department
Reference No.	
Date	