Course Specification

(Bachelor)

Course Title: Introduction to Real Analysis
Course Code: MTH1201
Program: BSc. in Mathematics
Department: Mathematics
College: Al-Qunfudah University College
Institution: Umm Al-Qura University
Version: 2
Last Revision Date: 17/07/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (4)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (4/2)

4. Course general Description:

This course is an introduction to Real Analysis, whose main contents are number systems, sequences, and series. This material is standard for a first course in Real Analysis for students pursuing a Mathematics major.

5. Pre-requirements for this course (if any): MTH1101

6. Pre-requirements for this course (if any):

7. Course Main Objective(s):

The aim of this course is to provide students with the main concepts of real analysis. Students learn the theory of sequences and series of real numbers.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4	100 %
2	E-learning	0	0
3	Hybrid • Traditional classroom • E-learning	0	0
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	36
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (***Exam, Quizzes, Activities…***)**	4
Total		40

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	**Outline basic properties of the real number system**	$K1, K3$	**Lecture and Tutorials**	**Exams, quizzes**
1.2	**Define supremum and infimum of a nonempty set**	$K2, K3$	**Lecture and Tutorials**	**Exams, quizzes**
1.3	**Recall concept of limits of sequences**	$K1, K3$	**Lecture and Tutorials**	**Exams, quizzes**
1.4	**Identify main properties of sequences**	$K2, K3$	**Lecture and Tutorials**	**Exams, quizzes**
1.5	**Recognize different convergence tests of numerical series**	$K3, K5$	**Lecture and Tutorials**	**Exams, quizzes**
2.0	Skills			
2.1	**Prove the elementary algebraic and order properties of ordered fields.**	$S1, S9$	**Lecture and Tutorials**	**Exams, quizzes**
2.2	**Prove the elementary properties of the real numbers.**	$S3, S5$	**Lecture and Tutorials**	**Exams, quizzes**
2.3	**Prove the convergence of the standard examples of sequences and series.**	$S3, S5, S9$	**Lecture and Tutorials**	**Exams, quizzes**
3.0	Values, autonomy, and responsibility			
3.1	**Write clear and precise proofs.**	$V2, V4$	**Lecture/ Individual or group work**	**Exams, quizzes**
3.2	**Appraise the real number system as a ''complete ordered field''**	$V2, V4$	**Lecture/ Individual or group work**	**Exams, quizzes**
3.3	**Use the theories, methods and techniques of the course to solve complex mathematical problems.**	$V2, V4$	**Lecture/ Individual or group work**	**Exams, quizzes**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.4	Justify the choice of different steps in problem resolution procedure.	*V2, V4*	Lecture/ Individual or group work	Exams, quizzes

C. Course Content

No	List of Topics	Contact Hours
1.	Number Systems: Peano's Axioms and Natural Numbers, the integers, and the rational numbers.	4
2.	Complete ordered fields: Definitions, Algebraic and order properties, Absolute value, Powers and Roots, Archimedean property, Infimum and supremum, Complete ordered field.	8
3.	Real numbers system: Basic properties, Bernoulli inequality.	4
4.	Sequence of real numbers: Subsequence, Monotone and Bounded sequence, Null sequence, Theorems and Examples, Convergent sequence, Theorems and Examples, Cauchy sequence, Bolzano-Weierstrass theorem.	14
5.	Series of real numbers: Convergent series, Tests for Convergence.	4
6.	.	6
Total		**40**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exam	6th	30 %
2.	Quizzes and homework's	During semester	20 %
3.	Final exam	End of semester	50 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• Introduction to Real Analysis, Robert G. Bartle, Donald R. Sherbert, 4th edition, (2011). ISBN: 978-0-471-43331- 6. • Elementary Analysis: the theory of analysis, 2nd Edition, Kenneth A. Ross.
Supportive References	• Guide to Analysis, F. Mary Hart, Macmillan Education, 1988
Electronic Materials	*None*

Other Learning Materials	*None*

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms**
Technology equipment (projector, smart board, software)	**Data Show, Smart Board**
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Courses Assessment survey**
Effectiveness of Students assessment		**Courses Assessment survey**
Quality of learning resources	**Students**	**Courses Assessment survey**
The extent to which CLOs have been achieved	**Faculty Member**	**Post-Rubric and Course report**
Periodically reviewing course effectiveness and planning for improvement	**Course committee**	**Annual report**

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Curriculum Committees
REFERENCE NO.	**1**
DATE	17/07/2024