Course Specification
(Bachelor)

Course Title:	**Real Analysis I**
Course Code:	**315MATH-3**
Program:	**BSc in Mathematics**
Department:	**Mathematics**
College:	**Science**
Institution:	**Jazan University**
Version:	**2024**
Last Revision Date:	9/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:	03

2. Course type

A. University ☐ College ☐ Department☒ Track☐ Others☐

B. Required ☒ Elective☐

3. Level/year at which this course is offered:

Level 6/ Year 3

4. Course general Description

This course is designed to provide students with

- **Real Numbers:** Algebraic Properties, Bernoulli's inequality, Cauchy's inequality, Triangle inequality, Topology of Real Number.
- **Sequences**: convergence, algebraic operations, theorems, subsequences, Bolzano Weierstrass Theorem, Cauchy criterion, Cauchy sequences.
- **Limits**: the precise definition, convergence criterion, divergence criteria, theorems, infinite limits, limits at infinity.
- **Continuity**: The precise definition of continuity, discontinuity criterion, continuity on intervals, combination of continuous functions, composition of continuous functions, Bolzano's Theorem(Intermediate Value), uniform continuity, relation between continuity and uniform continuity, uniform continuity criteria, Lipschitz functions.
- **Differentiation**: Theorems of differentiation, rules of differentiation, chain rule, derivative of inverse function, Fermat's theorem, Rolle's Theorem, Mean Value Theorem with its applications, Darboux's Theorem, L'Hopital's Rule, Taylor's Theorem.

5. Pre-requirements for this course (if any): Math 313

6. Co- requirements for this course (if any): None

7. Course Main Objective(s)

After finishing the course, the student is expected to be familiar with the following:

- Know algebraic and non-algebraic properties of R.
- Using different mathematical proof methods to prove some basic theorems in analysis.
- Using theorems to evaluate limits of sequences and functions.
- Distinguish between different types of continuity of functions.
- Using theorems to find derivative of some functions.
- Know the geometric meaning of important mathematical concepts; limit, continuity and derivative.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100%
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning		
4.	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	42
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	3
5.	Others (specify)	
	Total	45

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	Distinguishing mathematical concepts relevant to Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, differentiation, and The Real number system problems.	K1	Lectures, Web based work, Classroom dissections.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.2	Analysis structures and features of mathematics problems in real number System, Sequence of Real Numbers, and limit of functions, continuous functions, differentiation, and the Real number system.	K2	Lectures, Web based work, Classroom dissections.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.3	Outline required notations and concepts in Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions,	K3	Lectures, Web based work, Classroom dissections.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Differentiation, and The Real Number System problems.			
2.0	Skills			
2.1	Apply aspects relevant to Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	S1	Lectures, Web based work, Classroom dissections.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.2	Apply how to compute rates/quantities and Approximate Solutions in complex numbers problems.	S2	Lectures, Web based work, Classroom dissections.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.3	Apply various math rules, techniques and theorems in Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	S3	Lectures, Web based work, Classroom dissections.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.4	Apply mathematical problems using critical thinking and problem solving in Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	S4	Lectures, Web based work, Classroom dissections.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
3.0	Values, autonomy, and responsibility			
3.1	Cultivate a mathematical attitude and nurture the interest.	V1	Group work, problem solving, web based work	Assignments, Group work.
3.2	Leadership qualities in research and innovation with sense of Commitment and accountability.	V2	Group work, problem solving, web based work	Group work, Assignments
3.3.	Inculcating values and ethics in thought, expression and deed.	V3	Group work, problem	Group work.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			solving, web based work	

C. Course Content

No	List of Topics	Contact Hours
1.	Basics concepts related to the real numbers system.	8
2.	Sequence of Real numbers.	8
3.	Limit of functions.	9
4.	Continuous functions.	9
5.	Differentiation.	11
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and Quiz	3	5
2.	First exam	6	20
3.	Homework and Quiz	10	5
4.	Second exam	12	20
5.	Final exam	15	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*, R.G. Bartle and D.G. Sherbert, 3rd Edition. John Wiley and Sons, New York, 2000.
Supportive References	- Introduction to Real Analysis, M. Stoll, 2nd Edition, Addison Wesley Longman, Boston, 2001. - Elementary Analysis: Theory of Calculus K. A. Ross, Springer Verlag New York, 1980. - Principles of Real Analysis, D. Mahmoud Kutkut, Dar almarekh, 1990.
Electronic Materials	Websites and software dedicated to real numbers.
Other Learning Materials	- Power point presentations and other hand outs posted on the course website or on Blackboard.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, Computer Lab.
Technology equipment (projector, smart board, software)	Data show, Smart Board, Drawing Software.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	**Board Of Mathematics Department**
REFERENCE NO.	
DATE	**29/03/1446 A. H.; 02/10/2024 A. D.**