هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Real Analysis I**
Course Code:	**Math 315**
Program:	**B. Sc. in Mathematics**
Department:	**Mathematics**
College:	**Science**
Institution:	**Jazan University**

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A. Course Identification

1. Credit hours:	**03**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**Level 6/Year 3**
4. Pre-requisites for this course (if any)**:**	**Math-313**
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**	45	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	42
2	**Laboratory/Studio**	
3	**Tutorial**	3
4	**Others** (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course 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.

2. Course Main Objective

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.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding:**	
1.1	Distinguish 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
1.2	Identify background science, features and structure of mathematical problem in real number System, Sequence of Real Numbers, and limit of functions, continuous functions, differentiation, and the Real number system.	K2
1.3	Explain notations and concepts required for the solution of Mathematical problem in Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	K3
2	**Skills:**	
2.1	Apply theoretical, computational or practical aspect relevant to Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	S1
2.2	Compute numerical quantities for various parameters to approximate the solution in complex numbers problems.	S2
2.3	Apply various mathematical rules, techniques and theorems in Application on Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	S3
2.4	Solve mathematical problem using critical thinking in Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	S4
3	**Values:**	
3.1	Cultivate a mathematical attitude and nurture the interest.	V1
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.	V2
3.3	Inculcating values and ethics in thought, expression and deed.	V3

C. Course Content

No	List of Topics	Contact Hours
1	Basics concepts related to the real numbers system.	9
2	Sequence of Real numbers.	9
3	Limit of functions.	9

4	Continuous functions.	9
5	Differentiation.	9
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 and Understanding:**		
1.1	Distinguish mathematical concepts relevant to Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, differentiation, and The Real number system problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.2	Identify background science, features and structure of mathematical problem in real number System, Sequence of Real Numbers, and limit of functions, continuous functions, differentiation, and the Real number system.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.3	Explain notations and concepts required for the solution of Mathematical problem in Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.0	**Skills:**		
2.1	Apply theoretical, computational or practical aspect relevant to Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.2	Compute numerical quantities for various parameters to approximate the solution in complex numbers problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.3	Apply various mathematical rules, techniques and theorems in Application on Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.4	Solve mathematical problem using critical thinking in Real Number System, Sequence of Real Numbers, and Limit of functions, Continuous functions, Differentiation, and The Real Number System problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
3.0	**Values:**		
3.1	Cultivate a mathematical attitude and nurture the interest.	Group work, problem solving, web based work	Assignments
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.	Group work, problem solving, web based work	Assignments
3.3	Inculcating values and ethics in thought, expression and deed.	Group work, problem solving, web based work	Assignments

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework	3	5%
2	First exam.	6	20%
3	Second exam.	12	20%
4	Homework	14	5%
5	Final exam.	16	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 assigned to a teaching staff that will be available for help and academic guidance office hours at specific hours on daily basis. At least be available 8 hours per week.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	*Introduction to Real Analysis*, R.G. Bartle and D.G. Sherbert, 3rd Edition. John Wiley and Sons, New York, 2000.
Essential References Materials	- 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. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms, Computer Lab.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show, Smart Board, Drawing Software.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

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	**Board Of Mathematics Department**
Reference No.	**12th Meeting Of The Board Of Mathematics Department 1441-1442**
Date	**14/6/1442 A. H.; 27/1/2021 A. D.**