



Course Specification

— (Bachelor)

Course Title: Real Analysis 1

Course Code: 2023102-3

Program: Bachelor in Mathematics

Department: Mathematics and Statistics Department

College: Faculty of Sciences

Institution: Taif University

Version: 1

Last Revision Date: 20/05/2023



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A. General information about the course:

1. Course Identification

1. Credit hours: 3(3,0,0)

2. Course type

A. University College Department Track Others

B. Required Elective

3. Level/year at which this course is offered: Level 5 / Third Year

4. Course general Description:

This course covers the following fundamentals of mathematical analysis: the topology of the real line and some useful elementary inequalities are mentioned. They cover the properties of the real numbers, sequences of real numbers, limits of functions, continuity, differentiability, and some applications of differentiation such as mean value theorems, L'Hospital's rule and Taylor's theorem.

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

Calculus II (2022104-4)

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

None

7. Course Main Objective(s):

- Writing most essential properties of real numbers and the completeness axiom of real numbers. Introducing the algebraic and geometric structure of the real numbers
- Recognizing the basic topological properties of the real numbers. Studying sequences of real numbers. Recognizing several tests for convergence of sequences of real numbers. Studying continuity and uniform continuity for functions of real variables. Studying differentiability with some applications on differentiation. limit operations. Introducing the measure concepts, definitions and theorems with applications.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3Hr /Week	100%





No	Mode of Instruction	Contact Hours	Percentage
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	NA
3.	Field	NA
4.	Tutorial	NA
5.	Others (specify)	NA
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	Recognize the convergence for sequences of real numbers with main theorems.	K2	<ul style="list-style-type: none"> • Lectures • Group discussions 	<ul style="list-style-type: none"> • Exams • Assignments
1.2	Identify the convergence for sequences of real numbers with main theorems.	K2	<ul style="list-style-type: none"> • Lectures • Group discussions 	<ul style="list-style-type: none"> • Exams • Assignments
2.0	Skills			
2.1	Explain the meaning of concepts, notations and theorems of real analysis.	S2	<ul style="list-style-type: none"> • Interactive classes • Group discussions 	<ul style="list-style-type: none"> • Exams • Assignments
2.2	Demonstrate several methods for solving various problems concerning the subjects of this course.	S2	<ul style="list-style-type: none"> • Lectures • Group discussions • Interactive classes 	<ul style="list-style-type: none"> • Exams • Assignments



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.3	Apply some applications of differentiation.	S2	<ul style="list-style-type: none"> Interactive classes Group discussions 	<ul style="list-style-type: none"> Exams Assignments
3.0	Values, autonomy, and responsibility			
3.1	Work effectively within groups and independently.	V1	<ul style="list-style-type: none"> Projects 	<ul style="list-style-type: none"> Through the oral presentation of the projects
3.2	Articulate ethical behaviour associated with institutional Guidelines in classroom, and in Lab.	V3	<ul style="list-style-type: none"> Interactive classes 	<ul style="list-style-type: none"> Assignments

C. Course Content

No	List of Topics	Contact Hours
1.	The set \mathbb{R} of real numbers and its algebraic properties	3
2.	More properties such as maximum, minimum, supremum and infimum for any set of real numbers.	3
3.	The completeness axioms - Archimedean Property.	3
4.	The Topology of the real line -open sets and closed sets of real numbers -The Heine-Borel theorem-The nested set theorem-	3
5.	countable and uncountable sets.	3
6.	Sequences of real numbers - Limits of sequences, Monotone sequences.	3
7.	Cauchy sequences, Sub-sequences-Bolzano-Weierstrass theorem.	3
8.	First Midterm exam	3
9.	Trigonometric functions, \limsup 's and \liminf 's for real sequences.	3
10.	Series of real numbers. Tests of convergence for series, Alternating series and integral tests.	3
11.	Continuity - Properties of continuous functions. Theorems for continuous functions- uniform continuity.	3
12.	Applications of differentiation: Mean value theorems.	3
13.	Second Midterm exam	3
14.	L'Hospital's Rule- Examples on L'Hospital's Rule.	3
15.	Taylor's theorem with examples.	3
Total		45



D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Continuous Evaluation	10 %
2.	Assignments, report	Continuous Evaluation	10 %
3.	Midterm 1 Exam	8-9	15%
4.	Midterm 2 Exam	12-13	15%
5.	Final Exam	15-16	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	Peter A. Loeb; Real Analysis, 1st ed. 2016 Edition , John Wiley & Sons, Inc., Hoboken, NJ (1995). ISBN 10: 9783319307428, ISBN 13: 978-3319307428
Supportive References	Michael Field "Essential Real Analysis," Springer; 1st ed. 2017 edition, ISBN-10: 9783319675459, ISBN-13: 978-3319675459 and ASIN: 3319675451
Electronic Materials	Lectures available in Blackboard
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Data show, Blackboard
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, Program Leader	Direct & Indirect





Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of students assessment	Faculty, Program Leader	Direct
Quality of learning resources	Students, Faculty	Indirect
The extent to which CLOs have been achieved	Faculty	Direct & Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Department Council
REFERENCE NO.	4
DATE	October 2023

