هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Real Analysis (2)
Course Code:	2023202-4
Program:	Bachelor in Mathematics
Department:	Mathematics and Statistics Department
College:	Faculty of Sciences
Institution:	Taif University
Version:	1
Last Revision Date:	20/05/2023

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 4(4,0,0)					
2. Course type					
A.	☐University	☐College	☒ Department	☐ Track	☐Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: Level 6 / Third Year					
4. Course general Description:					
This course covers the following fundamentals of mathematical analysis: Riemann integrals, improper integrals, sequences and series of functions, uniform convergence. Also, it covers an introduction to measure theory such as Lebesgue integral, Lebesgue measure, and measurable functions.					
5. Pre-requirements for this course (if any):					
Real Analysis (1) 2023102-3					
6. Co-requirements for this course (if any):					
None					
7. Course Main Objective(s):					
The student will be taught as follows: • Introducing some methods and theorems of Riemann integration on the real line. • Recording improper integrals and testing their convergence. Also, recording sequences and series of functions, uniform convergence, and the interchange of 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	**4Hr /Week**	100%
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	60
2.	Laboratory/Studio	NA
3.	Field	NA
4.	Tutorial	NA
5.	Others (specify)	NA
Total		60

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 basic methods to compute Riemann integral and Fundamental Theorem of Calculus.	K1	• Lectures • Group discussions	• Exams • Assignments
1.2	Identify the measure theory. Memorize some concepts in measure theory.	K1	• Lectures • Group discussions	• Exams • Assignments
1.3	Outline the convergence tests of improper in integrals.	K1	• Lectures • Group discussions	• Exams • Assignments
2.0	Skills			
2.1	Explain the meaning of all concepts, notations and theorems that will be introduced in this course of real analysis 2.	S4	• Interactive classes • Group discussions	• Exams • Assignments
2.2	Apply several methods for	S4	• Lectures • Group discussions	• Exams • Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	solving various problems concerning the subjects of this course.		• Interactive classes	
3.0	Values, autonomy, and responsibility			
3.1	Work effectively within groups and independently	V1	• Projects	• Through the oral presentation of the projects
3.2	Articulate ethical behaviour associated with institutional Guidelines in classroom, and in Lab.	V3	• Interactive classes	• Assignments

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to integral	4
2.	Riemann integral: Upper and lower sums, leading to definition and properties of Riemann integral	4
3., 4.	Properties of Riemann integral and Intermediate Value Theorem for Integrals- Dominated Convergence Theorem- Monotone Convergence Theorem	8
5.	Fundamental Theorem of Calculus and Improper Integrals and absolutely convergent improper integrals	4
6.,7.	Sequences and Series of Functions Pointwise convergence - Uniform convergence -Cauchy condition for uniform convergence (Uniformly Cauchy	8
8.	First Midterm exam	4
9.	Properties of uniform convergence - Weierstrass M-test and Power Series - radius of convergence for the power series	4
10.	Differentiation and Integration of Power Series - Abel's Theorem and Weierstrass's Approximation Theorem	4
11.	Measure Theory: Outer measure—Caratheodory outer measure- inner measure-Lebesgue measure - measure on sigma algebra	4
12	measurable sets- The Cantor set- Existence of non-measurable sets- Lebesgue-Stieltje smeasure- Hausdorff measure.	4
13.	Second Midterm exam	4
14.	Regular outer measures – Carath´eodory-Hahn extension theorem	4
15.	Measurable Functions - Elementary Properties of Measurable Functions- Cantor-Lebesgue function - Limits of measurable functions	4

Total	60

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	Stein, R. Shakarchi, Real analysis. Measure theory, integration, and Hilbert spaces. Princeton Lectures in Analysis, III. Princeton University Press, Princeton, NJ, 2005
Supportive References	H. L. Royden and P. M. Fitzpatrick, Real analysis, fourth edition, China Machine Press 2010.
Electronic Materials	https:// www.S.O.S.math
Other Learning Materials	Matlab tutorial

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, Matlab software
Other equipment (depending on the nature of the specialty)	Wi-Fi internet connections

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Program Leader	Direct & Indirect
Effectiveness of students assessment	Faculty, Program Leader	Direct
Quality of learning resources	Peer Reviewer Students	Direct & 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

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