هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

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**

Table of Contents

A. Course Identification

1. Credit hours:4
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 9th level / 3th year
4. Pre-requisites for this course (if any)**:** **Real Analysis (1) 2023102-3**
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**	**5Hr /Week**	100
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	50
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	50

B. Course Objectives and Learning Outcomes

1. Course 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.

2. Course Main Objective

1. Introducing some methods and theorems of Riemann integration on the real line.
2. 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.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding:**	
1.1	Recognize the basic methods to compute Riemann integral and Fundamental Theorem of Calculus.	K1
1.2	Identify the measure theory. Memorize some concepts in measure theory	K1
1.3	Outline the convergence tests of improper in integrals.	K1
2	**Skills:**	
2.1	Explain the meaning of all concepts, notations and theorems that will be introduced in this course of real analysis 2.	S4
2.2	Apply several methods for solving various problems concerning the subjects of this course.	S4
3	**Values:**	
3.1	Work effectively within groups and independently.	V1
3.2	**Articulate ethical behaviour associated with institutional Guidelines in classroom, and in Lab.**	**V3**

C. Course Content

No	List of Topics	Contact Hours
1	Riemann integral: Upper and lower sums, leading to definition and properties of Riemann integral	5
2	Properties of Riemann integral and Intermediate Value Theorem for Integrals- Dominated Convergence Theorem- Monotone Convergence Theorem	5
3	Fundamental Theorem of Calculus and Improper Integrals and absolutely convergent improper integrals	5
4	Sequences and Series of Functions Pointwise convergence - Uniform convergence -Cauchy condition for uniform convergence (Uniformly Cauchy).	5
5	Properties of uniform convergence - Weierstrass M-test and Power Series - radius of convergence for the power series	5
6	**Midterm exam,** Differentiation and Integration of Power Series - Abel's Theorem and Weierstrass's Approximation Theorem	5
7	Measure Theory: Outer measure—Caratheodory outer measure- inner measure-Lebesgue measure - measure on sigma algebra	5
8	measurable sets- The Cantor set- Existence of non-measurable sets- Lebesgue-Stieltje smeasure- Hausdorff measure.	5
9	Regular outer measures – Carath´eodory-Hahn extension theorem	5
10	Measurable Functions - Elementary Properties of Measurable Functions- Cantor-Lebesgue function - Limits of measurable functions	5
Total		50

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	Recognize the basic methods to compute Riemann integral and Fundamental Theorem of Calculus. Record sequences and series of real-valued functions. Outline the convergence tests of improper in integrals.	• Lectures • Group discussions	• Exams • Assignments
1.2	Identify the measure theory. Memorize some concepts in measure theory	• Lectures • Group discussions	• Exams • Assignments
1.3	Outline the convergence tests of improper in integrals.	• 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	• Interactive classes • Group discussions	• Exams • Assignments
2.2	Apply several methods for solving various problems concerning the subjects of this course.	• Lectures • Group discussions • Interactive classes	• Exams • Assignments
3.0	**Values**		
3.1	Work effectively within groups and independently	Projects.	Through the oral presentation of the projects.
3.2	Articulate ethical behaviour associated with institutional Guidelines in classroom, and in Lab.	Interactive classes	• Assignments

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes + Home works**	**Continues**	**10 %**
2	**Midterm exam**	**5th-6th**	**30 %**
3	**Class Work (Homework- report- class test….)**	**8th**	**10 %**
4	**Final exam**	**11th**	**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:
6 hours per week (as defined in the teaching schedule of the faculty member) for academic advice and consultations.
Teaching staff is also available using Blackboard web site and Taif University "Edugate" System.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Stein, R. Shakarchi, Real analysis. Measure theory, integration, and Hilbert spaces. Princeton Lectures in Analysis, III. Princeton University Press, Princeton, NJ, 2005**
Essential References Materials	**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. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Lecture halls, containing white boards, and electronic monitors - The seats fit the number of students**
Technology Resources (AV, data show, Smart Board, software, etc.)	**Matlab software**
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**Wi-Fi internet connections**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Indirect
Quality of learning resources	Peer Reviewer Students	Direct Indirect
Extent of achieving the course learning outcomes	Peer Reviewer Students	Direct 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	Department of Mathematics and Statistics
Reference No.	11
Date	12-7-1443H

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