Course Specifications

Course Title:	**Real Analysis (1)**
Course Code:	**30113102-3**
Program:	**BSc. Mathematics**
Department:	**Mathematics**
College:	**Al-Leith University College**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:	3 hours
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	Level 5 / Third Year
4. Pre-requisites for this course (if any)	Introduction to Real Analysis 30112101-3
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**	3 Hours per Week	100%
2	**Blended**	0	0 %
3	**E-learning**	0	0 %
4	**Correspondence**	0	0 %
5	**Other**	0	0 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	(3 hours)x(15 weeks)
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify) Final exam, midterm exam, 4 quizzes	8 hours
	Total	53 hours
Other Learning Hours*		
1	**Study**	(2 hours)x(15 weeks)
2	**Assignments**	(2 hours)x(15 weeks)
3	**Library**	(2 hours)x(15 weeks)
4	**Projects/Research Essays/Theses**	5 hours
5	**Others** (specify)	
	Total	95 hours

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

As mentioned in previous modules, the main idea in analysis is to take limits. In Course " Introduction to Real Analysis" students learn to take limits of sequences of real numbers and learned to take limits of functions as a real number approached some other real number. We want to take limits in more complicated contexts. For example, students might want to have sequences of points in 3-dimensional space. Students might even want to define functions on spaces that are a little harder to describe, such as the surface of the earth. Students still want to talk about limits there. Finally, we have seen the limit of a sequence of functions in precedent chapters. We wish to unify all these notions so that we do not have to reprove theorems over and over again in each context. The concept of a metric space is an elementary yet powerful tool in analysis. And while it is not sufficient to describe every type of limit one can find in modern analysis, it gets us very far indeed.

2. Course Main Objective

The aims of this course are the following:
Be able to deal with different metric spaces and with some types of points such as interior, isolated, boundary and accumulation points.
Be Familiar with the concepts of open and closed sets.
Understand the concepts of connectedness and compactness.
Understand the concepts of connectedness and compactness.
Study the continuity of some functions.
Be familiar with the Baire category theorem and its applications.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Recognize the basic properties of metric spaces	K2
1.2	Describe the standard examples of metric spaces	K1
1.3	Examine continuous function between metric spaces	K5
1.4	Recall the neighborhood of a point and it's relation with open, closed and other sets	K3
1.5	Describe convergence of sequences as topological phenomenon	K1
2	**Skills :**	
2.1	Classify open and closed sets in metric spaces	S4
2.2	Associate open, closed sets and connected spaces.	S7
2.3	Investigate Cauchy sequences to study complete metric spaces	S2
2.4	Summarize main properties of compact metric spaces	S9
3	**Competence:**	
3.1	Generalize the main results in the real case to the metric spaces	C2
3.2	Write clear and precise proofs.	C5
3.3	Communicate effectively in both written and oral form.	C1

C. Course Content

No	List of Topics	Contact Hours
1	**Metric space:** Definition of metric spaces, basic properties and examples. Open and closed balls in metric spaces. Open and closed sets in metric spaces.	12
2	**Compact metric spaces.** **Connected metric spaces**	9
3	**Convergent sequences.** **Continuous mapping between metric spaces**.	9
4	Complete metric spaces Definition of Complete metric spaces The Archimedean principle in R Baire category theorem. Banach fixed point theorem. The Cantor Intersection Theorem for Complete Metric Spaces	12
5	Revision	3
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**		
1.1	Recognize the basic properties of metric spaces		
1.2	Describe the standard examples of metric spaces	Lectures Tutorials Discussion Quizzes	Exams Tutorials Quizzes group project
1.3	Examine continuous function between metric spaces		
1.4	Recall the neighborhood of a point and it's relation with open, closed and other sets		
1.5	Describe convergence of sequences as topological phenomenon		
2.0	**Skills**		
2.1	Classify open and closed sets in metric spaces	Tutorials Discussion Quizzes	Exams Tutorials Quizzes group project
2.2	Associate open, closed sets and connected spaces.		
2.3	Investigate Cauchy sequences to study complete metric spaces		
2.4	Summarize main properties of compact metric spaces		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.0	**Competence**		
3.1	Generalize the main results in the real case to the metric spaces		Exams Tutorials Quizzes group project
3.2	Write clear and precise proofs.		
3.3	Communicate effectively in both written and oral form.		

1. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Test (1)	6th week	20%
2	Midterm Test (2)	12th week	20%
3	Homework and Quizzes	During the semester	10%
4	Final Examination	End of semester	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 is assigned to a faculty member where he or she will provide academic advising. All faculty members are required to be in their offices outside teaching hours. Each faculty member allocates at least 4 hours per week to give academic advice and to answer to the questions of students about concepts studied during the lectures.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Mícheál O'Searcoid, Metric Spaces, Springer Undergraduate Mathematics Series, 2007
Essential References Materials	Irving Kaplansky, Set Theory and Metric Spaces (AMS Chelsea Publishing) 2nd Edition
Electronic Materials	http://ebookee.org/
Other Learning Materials	Microsoft Word

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Large classrooms that can accommodate more than 50 students.

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment.	Students	Direct
Quality of learning resources.	Students	Direct
Extent of achievement of course learning outcomes.	Faculty member	Direct

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	Council of Mathematics Department
Reference No.	
Date	

Council / Committee	Council of the Mathematics Department	The mathematical sciences (college of applied sciences) and the mathematics (Al Leith university college) department's first meeting of the coordinative committee
Reference No.	**4101050782**	**First meeting**
Date	**Sunday, 17 November 2019**	**Thursday, 17 October 2019**

Department Head

Dr. Ali Hassani