Course Specifications

Course Title:	**Rings and fields theory**
Course Code:	**30114407-3**
Program:	**BSc. Mathematics 301100**
Department:	**Mathematics**
College:	**Al Leith University College**
Institution:	**Umm Al Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 3 credit hours	

2. Course type
a.   University ☐   College ☐   Department ☑   Others ☐
b.   Required ☑   Elective ☐

3. Level/year at which this course is offered: Eighth level / fourth year

4. Pre-requisites for this course (if any)**:**

Group theory 30113403-3

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**	13.5 hours	30%
2	**Blended**	13.5 hours	30%
3	**E-learning**	7 hours	15.5%
4	**Correspondence**	7 hours	15.5%
5	**Other**	4 hours	9%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	(3 hours) x (15 weeks)
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (Exam)	(3 hours) x (2 weeks)
	Total	51 hours
Other Learning Hours*		
1	**Study**	70 hours
2	**Assignments**	15 hours
3	**Library**	0
4	**Projects/Research Essays/Theses**	0
5	**Others** (groupwork)	15 hours
	Total	100 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

This course will provide a detailed introduction to modern abstract algebra, which is a basic part of the language of much of modern mathematics. The course begins by recognizing the fundamental concepts of rings and fields. Then, it studies the question of factorization in rings and some examples of finite fields. Finally, it studies the theorem of principal ideal domain and the finding of a class of rings, known as unique factorization domains.

2. Course Main Objective

The purpose of this course is to introduce students by the concepts of rings, fields, rings of polynomials, field extension, and the different types of integral domains (PID, UFD, ED).

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define basic concepts of rings, polynomial rings, fields, field fractions, fields extensions and the splitting fields.	K3
1.2	Characterize the class of Euclidean rings as a class of rings like the ring of integers.	K1
1.3	Recognize the ring of polynomials over a commutative ring.	K3
1.4	Outline the properties of the finite fields.	K4
1.5	Memorize the different types of integral domain.	K1
2	**Skills :**	
2.1	Solve exercises about rings, fields and related subjects.	S1
2.2	Find the isomorphism between rings and between fields.	S2
2.3	Determine the structure of rings and fields.	S4
2.4	Draw a tower of subfields of a finite field.	S9
2.5	Extend a field from another field.	S2
3	**Competence:**	
3.1	Apply the computational and conceptual principles of rings and fields to solving basic facts of algebraic structures.	C2
3.2	Work effectively in teams.	C1

C. Course Content

No	List of Topics	Contact Hours
1	Rings and fields: Definitions and basic examples substructures of rings, ideals	6
2	Integral domain, the field of fractions of an integral domain	6
3	Rings of polynomials and factorization of polynomials over a field	6
4	Isomorphism theorems of rings	6
5	Prime and Maximal ideals	6
6	Introduction to extension fields and some examples of finite fields.	6
7	Principal ideal domain (PID), Unique factorization domain (UFD), Euclidean domain (ED)	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**		
1.1	Define basic concepts of rings, polynomial rings, fields, field fractions, fields extensions and the splitting fields.	Lectures Tutorials	Exams (Quizzes, Midterm and Final).
1.2	Characterize the class of Euclidean rings as a class of rings like the ring of integers.		
1.3	Recognize the ring of polynomials over a commutative ring.		
1.4	Outline the properties of the finite fields.		
1.5	Memorize the different types of integral domain.		
2.0	**Skills**		
2.1	Find the isomorphism between rings and between fields.	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Homework
2.2	Extend a field from another field.		
2.3	Calculate the prime and maximal ideals		
2.4	Prove the theorems of principal ideal domain, unique factorization domain and Euclidean domain .		
3.0	**Competence**		
3.1	Apply the computational and conceptual principles of rings and fields to solving basic facts of algebraic structures.	Lecture Small group work.	Homework (small group)
3.2	Work effectively in teams.		

2. 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 + Reports + 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	A First Course in Abstract Algebra (7th Edition), B. Fraleigh, Pearson (2002).
Essential References Materials	Modern Algebra: An Introduction (6th Edition), John R. Durbin, Wiley (2008).
Electronic Materials	- http://www.math.niu.edu/~beachy/abstract_algebra/study_guide/contents.html - https://en.wikipedia.org/wiki/Ring_theory - https://en.wikipedia.org/wiki/Algebraic_structure - http://mathworld.wolfram.com/topics/RingTheory.htl - http://mathworld.wolfram.com/topics/FieldTheory.htl
Other Learning Materials	None.

2. Facilities Required

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