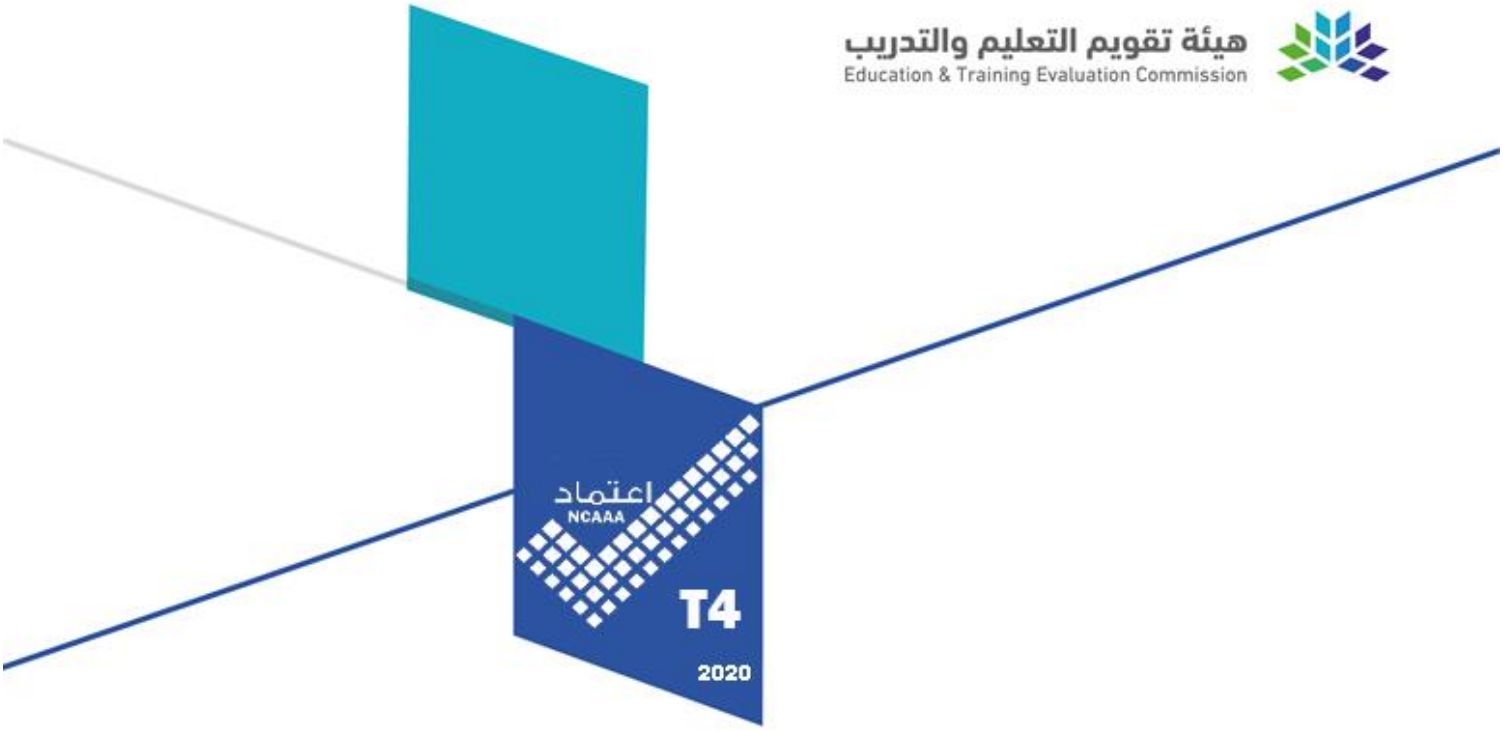
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	Rings and Fields	
Course Code:	**MTH 444**	
Program:	**B.Sc in Mathematics**	
Department:	**Mathematics Department**	
College:	**College of Science at Al- Zulfi**	
Institution:	**Majmaah University**	

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A. Course Identification

1. Credit hours: 4(3+1)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 7th
4. Pre-requisites for this course (if any): MATH343
5. Co-requisites for this course (if any)**: N/A**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	32	70 %
2	**Blended**	9	20 %
3	**E-learning**	4	10 %
4	**Correspondence**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	25
2	**Laboratory/Studio**	0
3	**Tutorial**	15
4	**Others** (specify) Seminars and presentations	15
	Total	

B. Course Objectives and Learning Outcomes

1. Course Description

On successful completion of the module, students should be able to:

- Determine the ideals of a given ring
- Determine the factor ring of a ring modulo an ideal.
- Determine the splitting field of a polynomial.
- Characterize prime and maximal ideal in many particular rings.
- To establish that two rings are isomorphic
- Prove that a ring is a field.
- Determine the ideals of a factor ring
- Easily work with polynomials as element of A[X]
- To practice the Euclidian division in K[X] and determine the gcd lcm of polynomials.
- Do calculations inside a finite field.
- Construct finite fields from a field of polynomial over a finite field and an irreducible polynomial.
- Draw the table of Fp[X]/<P(X)>.

2. Course Main Objective

The course is self-contained and doesn't need to be changed. However, the computer can be used intensively to make the course sufficiently clear and this needs to install many software as Mathematica, Macauley, Matlab and other…

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	State the axioms defining a ring, Integral domain, invertible element, a field, an ideal, prime and maximal ideals and consequences.	We first introduce new notions, give examples from the simple ones (numbers sets) to those related to matrices, functional sets, we establish the attached properties, we give and prove different theorems related to those notions. Finally, we construct new examples and concepts. To well fix the principal facts, homework is proposed.
1.2	Deduce simple statements from these axioms.	
١,٣	Provide examples of different simple ring structures.	
١,٤	Determine the image and the kernel of a ring homomorphism.	
١,٥	State, prove and apply some of the classical theorems of elementary Rings and Fields Theory.	
١,٦	Apply Bezout's theorem and Gauss's theorem in Euclidian ring in particular K[X].	
1.7	Construct new finite fields in view to be applied to coding and cryptography.	
1.8	Study the extension of fields	

CLOs		Aligned PLOs
2	**Skills :**	
2.1	The ability to recognize a ring, ideal and field structure.	C2
2.2	The ability to design new rings by constructing factor ring, to define their ideals and to distinguish the principal, the prime and the maximal ones.	C2
3	**Values:**	
3.1		
3.2		
3.3		
3...		

C. Course Content

No	List of Topics	Contact Hours
1	Rings and group of units of a ring, Group of automorphisms of a ring.	8h
2	Ideals and the quotient rings. Principal rings. Prime and Maximal ideals. Fields, Field of quotients of an integral domain. Characteristic of a ring	12h
3	Direct sum of rings. Modules over a ring	8h
4	Euclidian rings. The ring of polynomials A[X1,X2,…,Xn] over a ring A. Roots of polynomials over a Field K.	8h
5	Finite Fields and Application	4h
6	Extension of fields. Simple and finite extensions of fields.	8h
7	Splitting fields and Algebraic Closures. Finite fields.	8h
Total		56

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	State the axioms defining a ring, Integral domain , invertible element , a field, an ideal, prime and maximal ideals and consequences.	We first introduce new notions, give examples from the simple ones (numbers sets) to those related to matrices, functional sets, we establish the attached properties, we give and prove different theorems related to those notions. Finally, we construct new	-MCQ on principal theorems -Proving additional notions that can been elaborated from the general study -In general we introduce a short question to control the ability of the student to make the relationship between
1.2	Deduce simple statements from these axioms.		
1.3	Provide examples of different simple ring structures.		
1.4	Determine the image and the kernel of a ring homomorphism.		
1.5	State, prove and apply some of the classical theorems of elementary Rings and Fields Theory.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.6	Apply Bezout's theorem and Gauss's theorem in Euclidian ring in particular K[X].	examples and concepts. To well fix the principal facts, homework is proposed.	all the parts of the course.
1.7	Construct new finite fields in view to be applied to coding and cryptography.		
1.8	Study the extension of fields		
2.0	**Skills**		
2.1	The ability to recognize a ring, ideal and field structure.	Explanations and examples given in lectures.	Short questions and discussion during the tutorial class+ short quizzes.
2.2	The ability to design new rings by constructing factor ring, to define their ideals and to distinguish the principal, the prime and the maximal ones.	Guidance and supervision of the work developed in tutorial classes.	
2.3	To have the ability to construct integral domain as a factor of a ring by a prime ideal, and a field as a factor ring of a ring by a maximal ideal.	By using many examples	
2.4	The ability to make calculus the ring of polynomials and to be able to determine the gcd of two polynomial and to determine if they are coprime using Bezout's theorem or any related theorem .		
2.5	To be able to apply Gauss's theorem and in some cases to determine the roots of a polynomial .	Some examples	
2.6	To be able to manipulate the principal ring,	Apply almost all theorems to the case of polynomial ring.	
2.7	To be able to construct finite fields as a factor ring of polynomials on finite field by an irreducible ideal.	Construct finite fields from simple ones.	
2.8	To be able to draw the tables of F_pn[X]/<P>		
3.0	**Values**		
3.1	The students should be able to formulate and solve mathematical problems such as:	**Direct teaching**: Lectures **Aimed teaching**: Discovery and oral questions **Indirect teaching**: Cooperative Learning	• Homework • Quiz • Midterms • Final Exams
3.2			
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	1	Midterm 1	7th week
2	3	Homework	Through of semester
3	4	Quizzes	Through of semester
4	5	Electronic Test	13th week
5	6	Presentation	Through of semester
6	7	Final exam	End of semester
7	1	Midterm 1	7th week
8			

***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:

1- 4-office hours per week in the lecturer schedule.

- Sunday 10-12.
- Wednesday 12-15.

2- The contact with students by e-mail and website.
3- activation of the virtual classrooms and academic guidance via Black Board **LMS**.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	- Groups, Rings and Fields, J David A.R. Wallace, Springer, 2001, ISBN 1540763772-0, 13: 9783540761778 - Introduction to Finite Fields and their Applications, R. Lidl and H. Niederreiter, Cambridge University Press, 1994, ISBN 9781139172769, 9780521460941.

Essential References Materials	-Commutative Ring Theory (Cambridge Studies in Advanced Mathematics) , H. Matsumura, Miles Reid, June 30, 1989 | ISBN-10: 0521367646 | ISBN-13: 978-0521367646. -Commutative Algebra: with a View Toward Algebraic Geometry (Graduate Texts in Mathematics) , David Eisenbud, March 1, 1999 | ISBN-10: 0387942696 | ISBN-13: 978-0387942698. -A Guide to Groups, Rings, and Fields , Fernando Q. Gouvêa, Dolciani Mathematical Expositions, 2012, ISBN: 0883853558
Electronic Materials	http://www.gap-system.org/Releases/index.html
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- Classroom with capacity of 30-students. - Computer Lab of Mathematics Department
Technology Resources (AV, data show, Smart Board, software, etc.)	Mathematical software packages like MATHEMATICA
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	https://www.intmath.com/plane-analytic-geometry/intro.php http://mathworld.wolfram.com/topics/Geometry.html

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students/ internal committee	Direct (Students evaluation electronically organized by Deanship of registration and admission)/ Verification of students' papers
Extent of achievement of course learning outcomes	Staff members (Peer Reviewer)	Indirect (Frequent meetings consultation among the teaching staffs)
Quality of learning resources.	Staff members (course coordinators)	Direct (Meeting between course coordinators and the tutors)

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	Mathematics Department
Reference No.	27
Date	8/8/1442 H -21/3/2021 G

Head of Department

Dr. Muqrin Almuqrin