مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name: Modern Algebra 2

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Course Syllabus

1	**Course title**	Modern Algebra 2
2	**Course number**	0331442
3	**Credit hours**	3
	Contact hours (theory, practical)	3+0
4	**Prerequisites/corequisites**	0301341
5	**Program title**	B.S. in Mathematics
6	**Program code**	
7	**Awarding institution**	The University of Jordan
8	**School**	Science
9	**Department**	Department of Mathematics
10	**Course level**	Obligatory major requirement
11	**Year of study and semester (s)**	Senior year, any semester.
12	**Other department (s) involved in teaching the course**	None
13	**Main teaching language**	English
14	**Delivery method**	☑Face to face learning☐Blended ☐Fully online
15	**Online platforms(s)**	☑Moodle ☑Microsoft Teams ☐Skype☐Zoom ☐Others……
16	**Issuing/Revision Date**	

17 Course Coordinator:

Name:Dr. Osama Alkam	Contact hours:
Office number: Phone number: 22090	
Email:oalkam@ju.edu.jo	

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18 Other instructors:

Name:
Office number:
Phone number:
Email:
Contact hours:
Name:
Office number:
Phone number:
Email:
Contact hours:

19 Course Description:

As stated in the approved study plan.
Rings, subrings, integral domains, factor rings and ideals. Ring homomorphisms; polynomial rings; factorization of polynomials; reducibility and irreducibility tests; divisibility in integral domains; principal ideal domains and unique factorization domains.

20 Course aims and outcomes:

A- Aims:

1. In Modern Algebra I, students learn about groups and many of their properties. A group is a set with one operation and this operation satisfies certain conditions. In many important groups, there is another operation that is not considered in group theory. For instant numbers (Integers, rational numbers, ···), polynomials, functions, and matrices are structures with two operations, namely addition and multiplication. When considering these sets as groups, we simply use addition and ignore multiplication. In many cases, however, one want to consider both addition and multiplication. The concept of a ring does this, where a ring is a set endowed with two binary operations (addition and multiplication) and these two operations satisfy certain conditions. Students study rings and their properties and look at various examples of rings.
2. Commutative rings with unity, where cancellation law holds, are an abstraction of the Integers. These rings are called integral domains. Student will learn about integral domains and their properties. Also, students examine several examples of integral domains.
3. The concepts of an ideal and a factor ring are introduced. Ideals are used to construct and study sophisticated factor rings. Maximal and prime ideals are introduced and used to construct fields and integral domains.
4. Homomorphisms of rings are functions between rings that preserve the ring operations. One way to find out information about a ring is to study its interaction with other rings using homomorphisms. Students learn methods for determining whether two rings are essentially the same using ring isomorphism.
5. Polynomials will be more familiar to students. Students already know polynomials over the real numbers (or integers) in precalculus and calculus classes and worked on them as functions. As an abstraction, one can define polynomials with coefficients from commutative rings. These abstract structures are rings and are called polynomial rings. Students examine polynomial rings and study their properties.
6. In precalculus and calculus, students spend some time finding zeros of polynomials and factoring polynomials. In many cases, it is not easy to decide if a certain polynomial can be factored. Students learn some tests that enable them decide irreducibility of certain polynomials in more abstract setting. Also, students see how these irreducible polynomials can be used to construct fields.
7. Students are expected to spend two to three hours, after each class, reading the material given in class. They should be able to redo all proofs already done in class. Selected exercises are assigned at the end of each chapter. Students are expected to work these exercises on their own. They may discuss their ideas and solutions of these exercises with their peers. In case a student is unable to solve an exercise, he/she can ask about it in class. Students may be be asked to present their trials on some of these exercises in class.

B- Students Learning Outcomes (SLOs):

Upon successful completion of this course, students will be able to:

SLOs / SLOs of the course	SLO (1)	SLO (2)	SLO (3)	SLO (4)	SLO (5)	SLO (6)	SLO (7)	SLO (8)
Learn introductory concepts, and apply basic theorems and proof techniques of rings, integral domains and fields.							•	
Define, interpret, and analysefundamental principles and theory concerning subrings, ideals, principal ideals, prime ideals, maximal ideals, quotient rings, Boolean rings, and direct sum ofrings.							•	
Know and apply the concepts of ring homomorphisms and isomorphisms.							•	
Know facts about division algorithm of polynomials over fields and its consequences. Apply various irreducibility tests of polynomials.							•	
Know the concepts of divisibility, primes, irreducibles, uniquefactorizationdomains,principal ideal domains and EuclidianDomains.							•	

21 . Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous/ Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1	Introduction to Rings: Definition and Examples.	7	Face-to-face	Teams		Tests	Textbook
	1.2	Properties of Rings.	7	Face-to-face	Teams		Tests	Textbook
	1.3	Properties of Rings.	7	Face-to-face	Teams		Tests	Textbook
2	2.1	Subrings	7	Face-to-face	Teams		Tests	Textbook
	2.2	Exercises 1, 2, 4, 6, 8, 13, 17-19, 23, 25, 26, 28, 29, 31, 38, 39, 42, 43, 45, 46, 49, 50,51.	7	Face-to-face	Teams		Tests	Textbook
	2.3	Integral Domains: Definition and Examples, Fields, Characteristic of a Ring.	7	Face-to-face	Teams		Tests	Textbook
Week	**Lecture**	**Topic**	**Student Learning Outcome**	**Learning Methods (Face to Face/Blended/ Fully Online)**	**Platform**	**Synchronous / Asynchronous Lecturing**	**Evaluation Methods**	**Resources**
3	3.1	Integral Domains: Definition and Examples, Fields, Characteristic	7	Face-to-face	Teams		Tests	Textbook

		of a Ring.							
	3.2	Integral Domains: Definition and Examples, Fields, Characteristic of a Ring.	7	Face-to-face	Teams		Tests	Textbook	
	3.3	Exercises4-16, 20, 22, 26, 28, 30-32, 38, 40, 42, 45a, 48, 53- 56.	7	Face-to-face	Teams		Tests	Textbook	
4	4.1	Ideals and Factor Rings: Ideals, Factor Rings, Prime Ideals and Maximal Ideals.	7	Face-to-face	Teams		Tests	Textbook	
	4.2	Ideals and Factor Rings: Ideals, Factor Rings, Prime Ideals and Maximal Ideals.	7	Face-to-face	Teams		Tests	Textbook	
	4.3	Ideals and Factor Rings: Ideals, Factor Rings, Prime Ideals and Maximal Ideals.	7	Face-to-face	Teams		Tests	Textbook	
5	5.1	Ideals and Factor Rings: Ideals, Factor Rings, Prime Ideals and Maximal Ideals.	7	Face-to-face	Teams		Tests	Textbook	
	5.2	Ideals and Factor Rings: Ideals, Factor Rings, Prime	7	Face-to-face	Teams		Tests	Textbook	

		Ideals and Maximal Ideals.							
	5.3	Exercises 6-8, 11, 13, 14, 16, 18, 22, 24, 26-28, 32-37, 39, 45-47, 51, 56, 59, 60.	7	Face-to-face	Teams		Tests	Textbook	
6	6.1	Ring Homomorphisms: Definition and Examples, Properties of Ring Homomorphisms, The Field of Quotients.	7	Face-to-face	Teams		Tests	Textbook	
	6.2	Ring Homomorphisms: Definition and Examples, Properties of Ring Homomorphisms, The Field of Quotients.	7	Face-to-face	Teams		Tests	Textbook	
	6.3	Ring Homomorphisms: Definition and Examples, Properties of Ring Homomorphisms, The Field of Quotients.	7	Face-to-face	Teams		Tests	Textbook	
7	7.1	Ring Homomorphisms: Definition and Examples, Properties of Ring	7	Face-to-face	Teams		Tests	Textbook	

		Homomorphisms, The Field of Quotients.							
	7.2	Ring Homomorphisms: Definition and Examples, Properties of Ring Homomorphisms, The Field of Quotients.	7	Face-to-face	Teams		Tests	Textbook	
	7.3	Exercises5, 6, 8, 10, 13, 15, 16, 18, 20, 18, 20, 23-28, 31-36, 44-46, 49-51, 60,65.	7	Face-to-face	Teams		Tests	Textbook	
8	8.1	Polynomial Rings: Notation and Terminology, The Division Algorithm and Consequences.	7	Face-to-face	Teams		Tests	Textbook	
	8.2	Polynomial Rings: Notation and Terminology, The Division Algorithm and Consequences	7	Face-to-face	Teams		Tests	Textbook	
	8.3	Polynomial Rings: Notation and Terminology, The Division Algorithm and Consequences	7	Face-to-face	Teams		Tests	Textbook	
9	9.1	Polynomial Rings: Notation and Terminology,	7	Face-to-face	Teams		Tests	Textbook	

		The Division Algorithm and Consequences							
	9.2	Polynomial Rings: Notation and Terminology, The Division Algorithm and Consequences	7	Face-to-face	Teams		Tests	Textbook	
	9.3	Exercises 2, 3, 6, 9-17 odd, 21-23,25, 26, 29-31, 38, 39, 42, 43, 47.	7	Face-to-face	Teams		Tests	Textbook	
10	10.1	Factorization ofPolynomials : Reducibility Tests, Irreducibility Tests, Unique Factorization in Z[x].	7	Face-to-face	Teams		Tests	Textbook	
	10.2	Factorization of Polynomials: Reducibility Tests, Irreducibility Tests, Unique Factorization in Z[x].	7	Face-to-face	Teams		Tests	Textbook	
	10.3	Factorization of Polynomials: Reducibility Tests, Irreducibility Tests, Unique Factorization in Z[x].	7	Face-to-face	Teams		Tests	Textbook	
Week	**Lecture**	**Topic**	**Student Learning Outcome**	**Learning Methods (Face to Face/Blended/ Fully Online)**	**Platform**	**Synchronous / Asynchronous Lecturing**	**Evaluation Methods**	**Resources**	
11	11.1	Factorization of	7	Face-to-face	Teams		Tests	Textbook	

		Polynomials: Reducibility Tests, Irreducibility Tests, Unique Factorization in Z[x].							
	11.2	Factorization of Polynomials: Reducibility Tests, Irreducibility Tests, Unique Factorization in Z[x].	7	Face-to-face	Teams		Tests	Textbook	
	11.3	Exercises2 - 11, 13, 21, 22, 24-26, 31, 32.	7	Face-to-face	Teams		Tests	Textbook	
12	12.1	Divisibility and Integral Domains: Irreducibles and Primes, Unique Factorization Domains, Euclidian Domains.	7	Face-to-face	Teams		Tests	Textbook	
	12.2	Divisibility and Integral Domains: Irreducibles and Primes, Unique Factorization Domains, Euclidian Domains.	7	Face-to-face	Teams		Tests	Textbook	
	12.3	Divisibility and Integral Domains: Irreducibles and Primes, Unique Factorization Domains, Euclidian	7	Face-to-face	Teams		Tests	Textbook	

		Domains.							
13	13.1	Divisibility and Integral Domains: Irreducibles and Primes, Unique Factorization Domains, Euclidian Domains.	7	Face-to-face	Teams		Tests	Textbook	
	13.2	Divisibility and Integral Domains: Irreducibles and Primes, Unique Factorization Domains, Euclidian Domains.	7	Face-to-face	Teams		Tests	Textbook	
	13.3	Exercise 1-5, 8, 12, 13-15, 17,18, 20-23, 25, 27, 28, 30, 31, 36.	7	Face-to-face	Teams		Tests	Textbook	
14	14.1	Revision Exercises	7	Face-to-face	Teams		Tests	Textbook	
	14.2	Revision Exercises	7	Face-to-face	Teams		Tests	Textbook	
	14.3	Revision Exercises	7	Face-to-face	Teams		Tests	Textbook	
15	15.1	Revision Exercises	7	Face-to-face	Teams		Tests	Textbook	
	15.2	Revision Exercises	7	Face-to-face	Teams		Tests	Textbook	
	15.3	Revision Exercises	7	Face-to-face	Teams		Tests	Textbook	

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22 Evaluation Methods:

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	SLOs	Period (Week)	Platform
Midterm	30	Introduction to rings. Integral domains. Ideals and factor rings. Ring homomorphisms	7	8	In class written exam
Second exam	20	Polynomial rings. Factorization polynomials.	7	11	In class written exam
Final	50	All topics	7	Final exams period	In class

23 Course Requirements

- **(e.g: students should have a computer, internet connection, webcam, account on a specific software/platform…etc):**
  An account on Microsoft Teams.

24 Course Policies:

According to university regulations, attendance is mandatory. If a student is unable to attend a class, then he/she should contact the instructor. If a student misses more than 10% of the classes without excuse, then he/she will be assigned a falling grade in class.
In cases of extreme emergency or serious illness, the student will be allowed to make up the missed exams. Times and dates for makeup exams will be assigned later.
There are severe sanctions for cheating, plagiarizing and any other form of dishonesty. The university regulations on cheating will be applied to any student who cheats in exams or on any homework.

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25 References:

A- Required book(s), assigned reading and audio-visuals:

Contemporary Abstract Algebra, by J. Gallian. (seventh edition or later)

B- Recommended books, materials,and media:

1. A First Course in Abstract Algebra by J.Fraleigh.
2. Topics in Algebra by I.Herstein.
3. Abstract Algebra: an introduction, by T.Hungerford.

26 Additional information:

Name of Course Coordinator: Dr. Osama Alkam Signature: Date: 5/11/2022
Head of Curriculum Committee/Department: Prof. Ahmad Al Zghoul-- Signature: ----------
Head of Department: -Prof. Manal Ghanem - Signature: -M. Ghanem
Head of Curriculum Committee/Faculty: ---------- Signature: ----------
Dean: Mahmoud Jaghoub Signature: ----------