Course Specification

(Postgraduate Programs)

Course Title:	Commutative Algebra
Course Code:	MAT 7227
Program:	Doctor of Philosophy in Mathematics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	2024 – V1
Last Revision Date:	None

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A. General information about the course:

1. Course Identification:

1. Credit hours:					
4 (4 Lectures, 0 Lab, 0 Tutorial)					
2. Course type					
A.	☐ University	☐ College	☒ Program	☐ Track	☐ Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: Level 3 / Year 2					
4. Course General Description: None					
Commutative Algebra is the study of commutative rings, and their modules and ideals. This theory has developed over the last 150 years not just as an area of algebra considered for its own sake, but as a tool in the study of two important branches of mathematics: algebraic geometry and algebraic number theory. The resulting unification, where the same underlying algebraic structures arise both in geometry and in number theory, has been one of the crowning glories of twentieth century mathematics and still plays a fundamental role in current work in both these fields.					
5. Pre-requirements for this course (if any):					
None.					
6. Pre-requirements for this course (if any):					
None.					
7. Course Main Objective(s):					
The main objective of this course is to provide a solid grounding in commutative algebra to be used in algebraic geometry and number theory. The course will deepen and extend students' knowledge and understanding of commutative algebra. Moreover, familiar mathematical objects such as polynomials and algebraic numbers are presented.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**60**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
	Total	60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To state new tools that are useful in answering deep questions in commutative algebra.**	**K1, K2**	**4 lecture hours\week**	**Direct: Regular Exams**
1.2	**To list problems that are easily treated by applying commutative algebra methods.**	**K1, K2**	• **4 lecture hours\week** • **Self-study**	**Direct: Short Quizzes**
...				
2.0	**Skills**			
2.1	**To develop techniques of proof in commutative algebra**	**S1, S2**	**Self-study**	**Direct:** • **Participations** **Short Quizzes**
2.2	**To develop oral communication and technical writing skills through rings and modules.**	**S4**	**Real-life problems**	**Direct: Homework and Mini projects**
2.3	**To use Internet in searching for ideals and rings.**	**S3**	**Real-life problems**	**Direct: Short Quizzes**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.4	To write deep proofs of theorems on ideals and rings.	S1, S2	Self-study	Direct: Participations
...				
3.0	Values, autonomy, and responsibility			
3.1	To do course duties with independence and responsibility.	V1, V2	Personal questions	Direct: Participation
3.2	To participate with efficiency and cooperation in work groups.	V1, V3	Teamwork and class discussions.	Direct: Homework and Mini projects
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	Primary Decomposition and Associated Primes: Primary Submodules and Ideals, Primary Decomposition, Associated Primes, Associated Primes and Localization,The Support of a Module, Primary Decompositions in Noetherian Rings, Rings and Modules of Quotients.	10
2.	Total Ring of Quotients Artin-Rees Lemma and Krull Intersection Theorem, Nakayama Lemma.	10
3.	Tensor Product and Flatness, Flat and Projective Ideals, Hereditary and Semi Hereditary Rings, Flintily Presented Ideals and Coherent Rings.	10
4.	Integral Extensions: Integral Elements, Integrality and Localization, Going Down.	10
5.	Krull Dimension, Valuation Rings, Krull Domains, The Krull Intersection Theorem, Fractional and Invertible Ideals, Prufer Domains, Dedekind Domains, Arithmetical Rings.	10
6.	R-Sequences and Macaulay Rings, Principal Ideal Theorem, Regular Rings.	10
Total		60

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini projects	During the semester	30%
2.	Midterm	Week 9-10	30%
3.	Final Exam	Week 15-16	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Gregor Kemper, A Course in Commutative Algebra 2009 **(Main Reference)**
Supportive References	
Electronic Materials	David Eisenbud, Commutative Algebra: with a View Toward Algebraic Geometry (2005) **Robert B. Ash A Course In Commutative Algebra, 2003**
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (Projector, smart board, software)	**The rooms are equipped with data show and Smart Board.**
Other equipment (Depending on the nature of the specialty)	**None**

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Effectiveness of students' assessment	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
The extent to which CLOs have been achieved	**Instructor**	**At the end of each semester the course instructor should**

Assessment Areas/Issues	Assessor	Assessment Methods
		complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.
Other	None	

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	05/04/1446 (08/10/2024)