A	**Course Number & Title**	**MTH 733 - Commutative Algebra**
B	**Prerequisite**	**Prerequisite**: Admission to the PhD-MTH program. **Required Background**: Basic knowledge of ring theory and field theory.
C	**Number of credits**	3-0-3
D	**Faculty Name**	Ayman Badawi
E	**Term/ Year**	
F	**Sections**	CRN: 20503 | Days: MW | Time: 18--19:15 | Location: Nab 06
G	**Instructor Information**	Office: NAB262 | Telephone: | Email: abadawi@aus.edu **Office Hours:** • MW: 14--15:15 and TR 12:40--13:40 • Or by appointment just email me
H	**Course Description from Catalog**	Covers prime ideals and their generalizations, integral elements, modules and matrices over commutative rings, exact sequence, primary decomposition, and Noetherian and Artinian rings.
I	**Course Learning Outcomes and Assessment Instruments**	**Learning Outcomes** Upon completion of this course, students will be able to: — **Assessment Instruments** 1. Produce proofs of fundamental theorems of commutative algebra and use them to solve problems. — HW & Exam1 2. Analyze different types of matrix forms — HW, Exam 2, and Final 3. Discuss proofs of statements about commutative rings and modules over them — HW, Exam I, Exam 2, and Final 4. Construct examples of particular types of rings and modules. — HW, Exam 2 &Final
J	**Textbook and other Instructional Material and Resources**	**Primary: Class Notes** M. Atiyah and I. Macdonald (2018). Introduction to Commutative Algebra. CRC Press. eBook ISBN 978-0-4294-9363-8 : T. W. Hungerford (2012). Algebra, Springer, eBook ISBN: 10.1007/978-1-4612-6101-8
K	**Teaching and Lea, ring Methodologies**	- Whiteboard, markers, formal lectures, oral presentations, and class discussion
L	**Grading Scale, Grading Distribution, and Due Dates**	**Grading Scale**

90.00 – 100	4.0	A		71.00 – 75.00	2.7	B-
86.00 – 90.99	3.7	A-		66.60 – 70.99	2.3	C+
81.00– 85.99	3.3	B+		61.00 – 65.99	2.0	C
76.00 – 80.99	3.0	B		Less Than 61	0	F

		Grading Distribution **Assessment** / **Weight** / **Due Date (Week #)** Homework — 22% — TBA Exam 1 — 22% — TBA Exam 2 — 22% — TBA Final Exam — 34% — TBA Total — 100%
M	**Explanation of Assessments**	• **Homework:** Homework Assignments will be assigned throughout the semester, **First exam:** There will be one written exam for the material up to week 5. • **Second exam:** There will be one written exam for the material up to week • 11. **Final Exam:** Final examination will be comprehensive. •
N	**Student Academic Integrity Code Statement**	Students MUST read the Student Academic Integrity Code outlined in the *AUS graduate* Catalog and abide by the standards for academic conduct, students' rights and responsibilities, and procedures for handling allegations of academic dishonesty.
O	**Generative AI Course Policy**	It is considered an academic integrity violation to represent output of a generative artificial intelligence tool as your own work.

SCHEDULE*

#	WEEK	TOPICS & ASSIGNED READING	NOTES
1		Prime ideals, localization of rings, and integral extension	Chapter one, Chapter 5 Class Notes (crucial)
2		Prime ideals, localization of rings, and integral extension II	Chapter one, Chapter 5 Class Notes (crucial)
3		Noetherian rings I	Chapters 6, 7 Class notes (crucial)
4		Noetherian rings II	Chapters 6, 7, class notes (crucial)

5		Artinian commutative rings	Chapter 8, class notes (crucial)
6		Module , the exact sequence, and Nakayama's lemma I	Exam 1 Chapters 2, 3, 4 Class Notes (Crucial)
7		Module, the exact sequence, and Nakayama's lemma II	Chapters 2, 3, 4 Class Notes (Crucial)
8		Module, the exact sequence, and Nakayama's lemma III	Chapters 2, 3, 4 Class Notes (Crucial)
9		Module, the exact sequence, and Nakayama's lemma IV	Chapters 2, 3, 4 Class Notes (Crucial)
10		Matrices over commutative rings I	Class Notes Hungerford, Chapter 7
11		Matrices over commutative rings II	Class Notes Hungerford, Chapter 7
12		Matrices over commutative rings III	Exam 2
13		Matrices over commutative rings IV	Class Notes Hungerford, Chapter 7
14		Matrices over commutative rings V	Class Notes Hungerford, Chapter 7

15		Discussion of open problems related to the materials discussed in the course	Research papers
16	FINAL EXAM		Compressive

* The teaching schedule is subject to change at the instructor's discretion, and students will be informed accordingly.

Contribution of Course to Program Outcomes

This course contributes to the accomplishment of the following program outcomes:

Program Outcome		Course Learning Outcomes
1. Demonstrate mastery of comprehensive, deep, and overarching knowledge of at least two main areas of mathematics such as algebra, analysis, dynamical systems, and statistics		1, 3
2. Apply advanced mathematical skills to solve problems and communicate solutions in precise mathematical language		1, 3, 4
3. Design, conduct and defend independent and original research in a specialized area of mathematics		1, 2, 3, 4
4. Effectively disseminate and communicate research outcomes to relevant audiences in both written and oral formats		1, 2, 3, 4
5. Uphold standards of ethical academic and professional conduct		1, 3, 4