A	**Course Number & Title**	**Discrete Mathematics – MTH 213**
B	**Pre/Co-requisite(s)**	Prerequisite: MTH 102 or MTH 103
C	**Number of credits**	3
D	**Faculty Name**	Ayman Badawi
E	**Term/ Year**	Fall 2024

F Sections

CRN	Days	Time	Location
11046	**MW**	**11:00—12:15**	**Nab 009**
11047	TR	11:00—12:15	Nab 009

G Instructor Information

Office	Telephone	Email
NAB 262	---	abadawi@aus.edu

Office Hours:

- MW: 13:00 – 14:15; T: 14:30—15:30W
- Or by appointment, email me

H Course Description from Catalog

(Equivalent to CMP 213). Covers propositional and predicate calculus, sets, significant classes of functions and related algorithms, asymptotic analysis of functions, the principle of mathematical induction, proof techniques, recursive definitions, counting, relations, graphs, and trees.

Computer science and computer engineering students who have not yet been formally admitted to the second-year level in their major are not eligible to take this course.

I Course Learning Outcomes and Assessment Instruments

Course Learning Outcomes (CLOs) Upon completion of this course, students will be able to:	**Assessment Instrument(s)**
Basic number theory	Exam 1 and/or Final
CLO1: Apply logic and mathematical reasoning.	Exam 1 and/or Final
CLO2: Perform different methods of proof including induction and proof by contradiction.	Exams 1, 2 and/or Final
CLO3: Identify and apply basic set theory principles.	Exam 2 and/or Final
CLO4: Identify and apply relations, and functions including one-to-one and onto functions.	Exam 2 and/or Final
CLO5: Apply basic principles of counting including the addition and multiplication rules, and the pigeonhole principle.	Final
CLO6: Use graph theory concepts, such as minimum spanning tree and traveling salesman problem, to model and solve a variety of network and real-life problems.	Exam 1 and/or Final
CLO7: Analyze different type of algorithms and their complexity and the order of algorithms.	

J **Mapping CLO's to PLO's**

Course Learning Outcomes	Program Learning Outcome: *The BSMTH CLOs are listed at the end of this document*
1. CLO1, CLO2	PLO1, PLO2, PLO3, PLO5, PLO8
2. CLO3, CLO5	PLO1, PLO8
3. CLO4	PLO1, PLO6, PLO8
4. CLO6	PLO6, PLO8
5. CLO7	PLO1, PLO6

K **Textbook and other Instructional Material and Resources**

Required: Badawi- Class- Notes, materials on I-Learn, essential old quizzes, notes, and exams on the MTH 213 webpage: https://ayman-badawi.com/MTH213.html

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(Optional) Susanna S. Epp, Discrete Mathematics with Applications, Metric Edition, 5th Edition, Brooks/Cole, Cengage Learning, 2020.

- **Sponsored students**: Contact the Office of Sponsored Students (Ms. Maha: mshushaa@aus.edu) for instructions on obtaining your access code.
- If you are **not** a sponsored student, you can buy the access code from the Bookstore (AllPrint). Instructions will follow soon.

L **Teaching Methods**

Lectures, oral presentations, and group discussion. All lecture notes and videos will be available on iLearn.

M **Grading Scale, Grading Distribution, and Due Dates**

Grading Scale (example)

93 – 100	4.0	A	73.00 – 77.99	2.3	C+
89.00 – 92.99	3.7	A-	68.00 – 72.99	2.0	C
86.00 – 88.99	3.3	B+	62.00 – 67.99	1.7	C-
81.00 – 85.99	3.0	B	50.00 – 61.99	1.0	D
78.00 – 80.99	2.7	B-	Less Than 50.00	0	F

Grading Distribution

Assessment	Weight	Due Date (Week #)
Quizzes	20%	Weekly/TBA
Exam 1	25%	Monday, October 14(M, W), Thursday Oct 16(T, R) In Class
Exam 2	25%	Monday, November 25(M, W), In Class, Thursday (T, R), November 27
Final Exam	30%	TBA
Total	100%	

N **Explanation of Assessments**

There will be two exams, quizzes, and a comprehensive final exam.

- No make-up quiz will be given. If you miss a quiz for whatever reason, you will get a zero for that quiz. *However, the lowest quiz grade will not count toward your grade.*
- With a valid written excuse and making immediate arrangements with the instructor, a missed exam might be replaced with a make-up exam or the grade of the final exam and/or the average grade of all tests (including final) and/or quizzes

O	**Attendance**	Students in this course are required to follow the AUS Attendance Policy as outlined in the *AUS Undergraduate Catalog.*
P	**Student Academic Integrity Code Statement**	Students MUST read the Student Academic Integrity Code outlined in the *AUS Undergraduate* Catalog and abide by the standards for academic conduct, students' rights and responsibilities and procedures for handling allegations of academic dishonesty.
Q	**Generative AI Course Policy**	**It is considered an academic integrity violation to represent the output of a generative artificial intelligence tool as your own work.**

Schedule(but not in order; I recommend following class notes)

WEEK	CHAPTER	NOTES
1	1: **Speaking Mathematically**	1.1 Variables 2.1 Logical Forms and Logical Equivalence
2	2: **The Logic of Compound Statements**	2.2 Conditional Statements 2.3 Valid and Invalid Arguments
3	3: **The Logic of Quantified Statements**	3.1 Predicates and Quantified Statements I 3.2 Predicates and Quantified Statements II 3.3 Statements with Multiple Quantifiers 3.4 Arguments with Quantified Statements
4	4: **Elementary Number Theory and Methods of Proofs**	4.1 Direct Proof and Counterexample I: Introduction 4.2 Direct Proof and Counterexample II: Writing Advice 4.3 Direct Proof and Counterexample III: Rational Numbers
5		4.4 Direct Proof and Counterexample IV: Divisibility 4.5 Direct Proof and Counterexample V: Division into Cases and the 4.7 Indirect Argument: Contradiction and Contraposition 4.8 Indirect Argument: Two Famous Theorems
6	5: **Sequences, Induction, and Recursion**	5.2 Mathematical Induction I 5.3 Mathematical Induction II 5.4 Strong Mathematical Induction
7		5.6 Defining Sequences Recursively 5.7 Solving Recurrence Relations by Iteration 5.8 Second-Order Linear Homogenous Recurrence Relations
8	6: **Set Theory**	1.2 The Language of Sets 6.1 Definitions and the Elements Method of Proof 6.2 Properties of Sets 6.3 Disproof and Algebraic Proofs
9	7: **Functions**	1.3 The language of Relations and Functions 7.1 Functions Defined on General Sets 7.2 One-to-One and Onto, Inverse Functions
10	8: **Relations**	8.1 Relations on Sets 8.2 Reflexivity, Symmetry, and Transitivity 8.3 Equivalence Relations 8.4 Modular Arithmetic with Applications to Cryptography
11	9: **Counting and Probability**	9.1 Introduction 9.2 Possibility Tree and the Multiplication Rule 9.3 Counting Elements of Disjoint Sets: the Addition Rule 9.4 The Pigeonhole Principle

12		Introduction to Graphs 10.1 Trails, Paths, and Circuits
13	10: **Graphs and Trees**	10.4 Trees 10.5 Rooted Trees
14	10: **Graphs and Trees/algorithm complexity**	10.6 Spanning Trees and Shortest Paths
15	11: **Analysis of Algorithm Efficiency**	11.3 Application: Analysis of Algorithm Efficiency I, 11.2 O-, Omega-, and Theta-Notations
16	**Final Exam (Comprehensive): TBA**	

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

BSMTH Program Learning Outcomes

PLO1: Demonstrate knowledge and understanding of diverse areas in mathematics such as analysis, algebra, discrete mathematics, and applied mathematics.

PLO2: Construct and effectively communicate valid mathematical arguments.

PLO3: Demonstrate a solid grounding in the ideas and techniques of mathematics.

PLO4: Apply mathematical analysis and mathematical skills to problems in other disciplines.

PLO5: Use discrete mathematical concepts in a variety of contexts, such as algorithm development, computer programming, and network development and implementation.

PLO6: Demonstrate the ability to identify and carry out thoughtful approaches to problem-solving.

PLO7: Define and execute simple research tasks and assist in more complex research tasks as required for professional work.

PLO8: Formulate a problem in mathematical terms from descriptions written in language specific to disciplines associated with engineering, finance, and the natural sciences.

PLO9: Obtain the research skills necessary to adapt to change, remain current in the field, and continue to learn new information, skills, and concepts.