



# UNIVERSITY OF SOUTHERN MINDANAO

## COURSE SYLLABUS for Abstract Algebra



Course Number

Math 316

Rev. No.

0

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EFFECTIVE DATE	REV. NO.	REVISION TYPE	CHANGE DESCRIPTION	PAGE AFFECTED	ORIGINATOR
July 04, 2022	Ø	New	Newly established in accordance with the Quality Management System Requirements	ALL	UQAC
			ELECTRONICALLY RELEASED 2025.07.09		

Author:	Reviewer:	Verifier:	Validator:	Final Approver:	DCC USE ONLY		
 LEORENICE C. TANDOG, PhD Course Developer	 DEBBIE MARIE B. VERZOSA, PhD Subject Expert	 LEONARD M. PALETA, PhD Department Chair	 JONALD L. PIMENTEL, PhD Dean	 GEOFFRAY R. ATOK, PhD Vice President for Academic Affairs	DOCUMENT CONTROL INDICATOR		
Date: 2022.06.20	Date: 2022.06.22	Date: 2022.06.23	Date: 2022.06.27	Date: 2022.06.28	MASTER 2022.07.04	COPY	





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### INSTITUTIONAL POLICIES

Vision	Quality and relevant education for its clientele to be globally competitive, culture sensitive and morally responsive human resources for sustainable development.
Mission	Help accelerate socio-economic development <sup>M<sub>1</sub></sup> , promote harmony among the diverse cultures <sup>M<sub>2</sub></sup> and improve quality of life <sup>M<sub>3</sub></sup> through instruction, research, extension and resource generation in Southern Philippines.
Core Values	<b>G</b> -Goodness, <b>R</b> -Responsiveness, <b>E</b> -Excellence, <b>A</b> -Assertion of Right and <b>T</b> -Truth.
USM Quality Policy Statement	<p>The University of Southern Mindanao, as a premier university, is committed to provide quality instruction, research development and extension services and resource generation that exceed stakeholders' expectations through the management of continual improvement efforts on the following initiatives.</p> <ol style="list-style-type: none"><li>1. Establish key result areas and performance indicators across all mandated functions;</li><li>2. Implement quality educational programs;</li><li>3. Guarantee competent educational service providers;</li><li>4. Spearhead need-based research outputs for commercialization, publication, patenting, and develop technologies for food security, climate change mitigation and improvement in the quality of life;</li><li>5. Facilitate transfer of technologies generated from research to the community for sustainable development;</li><li>6. Strengthen relationship with stakeholders;</li><li>7. Sustain good governance and culture, sensitivity; and</li><li>8. Comply with customer, regulatory and statutory requirements.</li></ol>
Goals of the College	<ol style="list-style-type: none"><li>1. The College of Science and Mathematics of the University of Southern Mindanao is committed to the comprehensive preparation of the next generation of scientists and mathematicians in this part of the country.</li><li>2. The College supplies a condition in which faculty can advance and support high-quality research programs in which students can collaborate and contribute to new knowledge that improves quality of life.</li><li>3. The College aspires to be the center of excellence in Science and Mathematics in order to serve diverse students, preparing them for their future careers in line with the vision and mission of the University.</li><li>4. The College serves the community and the industry as an impartial source of quality graduates in Science and Mathematics that provides education, literacy, innovation and solution generation to challenges.</li></ol>
Department Objectives	<p>The Department of Mathematics and Statistics aims to:</p> <ol style="list-style-type: none"><li>1. produce students with mastery in the core areas of mathematics and statistics, including algebra, analysis, and geometry;</li><li>2. develop students' skills in pattern recognition, generalization, abstraction, critical analysis, synthesis, problem-solving and rigorous argument;</li><li>3. express an enhanced perception of the vitality and importance of mathematics in the modern world including inter-relationships within math and its connection to other disciplines; and</li><li>4. develop students' skills in creating and evaluating mathematical conjectures and arguments, and in validating their own mathematical thinking.</li></ol>





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### PROGRAM INFORMATION

Degree Program	Bachelor of Science in Applied Mathematics	CHED CMO Reference	48 series of 2017	BOR Approval	BOR Res. No.
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### COURSE DETAILS

Course Title	Abstract Algebra				
Course Number	Math 316				
Credit (--Unit)	3 Units	LECTURE (Unit-Hours)	3 Units - 3 Hours	LABORATORY (Unit-Hours)	0 Units - 0 Hours
Prerequisites	None	Co-requisites	None	Year Level/Semester Offered	3 <sup>rd</sup> Year - First Semester
Course Description	Abstract algebra deals with the study of algebraic systems which consist of a set of elements and the operations defined on the set, together with certain laws that the operations are required to satisfy. This course primarily focuses on the introduction of one important algebraic system – the group.				
Faculty in charge	Leorence C. Tandog				
Consultation Hours					
Contact Information	Graduate School Office (09466115568)				

### PROGRAM EDUCATIONAL OBJECTIVES (PEO)

In 3-5 years, the **BSE Math** graduates of USM shall:

		MISSION		
		M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>
PEO 1	Provide leadership in various development programs both public and private			
PEO 2	Equip with technical, conceptual and human resource skills	✓		
PEO 3	Pursue entrepreneurial activities	✓		✓
PEO 4	Able to adapt to diverse culture	✓		✓
PEO 5	Pursue advanced studies in emerging related fields		✓	
			✓	✓

NOTE: The PEO's are based on the professional, industry, local, national and international needs and requirements of the program identified through consultation with constituents and stakeholders.

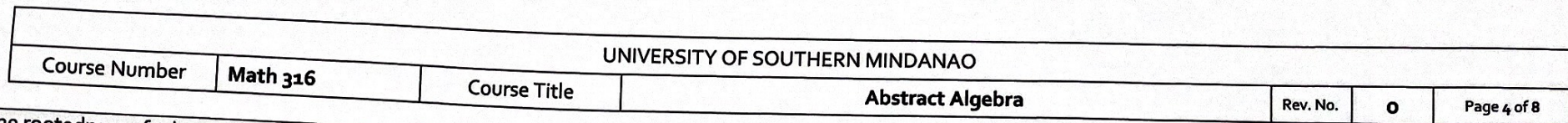
### PROGRAM OUTCOMES (PO)

Upon graduation, the University of Southern Mindanao **BS Applied Math** students must be able to:

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8	PEO9	PEO1	...
a) Articulate and discuss the latest development in the specific field of practice.		✓									
b) Effectively communicate orally and in writing using both English and Filipino		✓			✓						
c) Work effectively and independently in multidisciplinary and multi-cultural teams.			✓	✓							
d) Act in recognition of professional, social and ethical responsibility											
e) Preserve and promote "Filipino historical and cultural heritage"	✓										
f) Participate in the generation of new knowledge in research and development projects.		✓		✓							

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g.) Articulate the rootedness of education in philosophical, sociocultural, historical and psychological and political context.		✓		
h.) Demonstrate mastery of subject matter/discipline		✓		
i.) Facilitate learning using wide range of teaching methodologies and delivery modes appropriate to specific learners and their environment.		✓	✓	
j.) Develop innovative curricula, instructional plans, teaching approaches, and resources for diverse learners.		✓	✓	
k.) Apply skills in the development and utilization of ICT to promote quality, relevant and sustainable educational practices		✓		
l.) Demonstrate a variety of thinking skills in planning, monitoring, assessing and reporting learning processes and outcomes.		✓		
m.) Practice professional and ethical teaching standards sensitive to the local, national and global realities.	✓		✓	
n.) Pursue lifelong learning for personal and professional growth through varied experiential and field based opportunities			✓	
o.) Exhibit competence in mathematical concepts and procedures		✓		
p.) Exhibit proficiency in relating mathematics to other curricular areas		✓		
q.) Manifest meaningful and comprehensive pedagogical content knowledge (PCK) of mathematics.		✓		
r.) Demonstrate competence in designing, constructing, and utilizing different forms of assessment in mathematics.		✓		
s.) Demonstrate proficiency in problem-solving by solving and creating routine and non-routine problems with different levels of complexity.		✓		
t.) Use effectively appropriate approaches, methods, and techniques in teaching mathematics including technological tools		✓		
u.) Appreciate mathematics as an opportunity for creative work, moments of discovery, and gaining insight.		✓		

NOTE: Minimum PO's shall come from the PSG/CMO of the program if applicable. Other additional PO's may come from consultations with constituents and stakeholders.

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COURSE OUTCOMES (CO)		PO	PO	POc	POd	PO	POf	PO	PO	POi	POj	PO	POl	PO	PO	PO	PO	PO	POr	POs	POt	PO	PO	PO	PO	PO	PO
Upon passing this course, the students must be able to:		Course Alignment to Program Outcomes																									
CO 1	Interpret and apply the vocabulary, symbolism, and definitions basic to abstract algebra.			E	D				E							E						E					
CO 2	Perform manual or technology-aided operations under different algebraic structures.								E							I						E					
CO 3	Justify statements and arguments involving mathematical concepts and algebraic structures.			E					E							E											
CO 4	Strengthen perseverance and tenacity through problem solving.			E																		E					
					D																	E					

\* Level (follow the legend used in the most relevant PSG/CMO)

[I] = Introductory. This introduces the student to the Program Outcome

[E] = Enabling. This enables the student to

\* **Level** (follow the legend used in the most relevant PSG/CMO)

[I] = Introductory. This introduces the student to the Program Outcome (PO).

**[E] = Enabling.** This enables the student to attain the Program Outcome (PO)

**[D]** = Demonstrative. This demonstrates the student's attainment of the Program Outcome (PO)

## COURSE LEARNING PLAN

**Intended Learning Outcomes (ILO)**

## Course Content

Teaching &amp; Learning Activities (TLA) Learning Materials

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By the end of the learning experience*, students must be able to:	Aligned to CO:	Time Frame (Week)	(Topics)	Teaching Activities	Learning Activities	Assessment Tasks (AT)	Suggested Readings
<b>1.1</b> Explain the vision, mission, UQPS of the University <b>1.2</b> Explain the goals and objectives of the college. <b>1.3</b> Explain the Program Educational Objectives and Course Outcomes.		1-2	<ul style="list-style-type: none"> <li>Orientation on Class and University Policies as well as Grading System</li> <li>Discussion on PEO, SO and CO</li> </ul>	Giving instructions, clarifying and addressing student questions	Reading Assignment	Hand-outs USM webpage	Reflective Writing [1]
<b>2.1</b> Interpret proof symbols and logical quantifiers <b>2.2</b> Prove mathematical statements using different methods of proofs	CO3 CO4	3-4	<b>Methods of Proof</b> <ul style="list-style-type: none"> <li>Mathematical Proofs and Symbols</li> <li>Logical Quantifiers</li> <li>Negation of Mathematical Statements</li> <li>Direct and Indirect Proofs</li> <li>Proof by Contradiction</li> <li>Proof by Counterexample</li> <li>Proofs for Existential Statements</li> </ul>	-Synchronous lecture -clarifying and addressing student questions	Answer workbook examples and practice exercises	-Text/Workbook Worksheets -Powerpoint Presentation -Online Resource: Methods of Proof – (youtube.com)	-Problem Set -Quiz [1] [2] [6]
<b>3.1</b> Discuss set partitions. <b>3.2</b> Write Cartesian products and relations on different sets <b>3.3</b> Classify relations according to types as reflexive, symmetric, etc. <b>3.4</b> Prove equivalence relations and write the induced set partitions <b>3.5</b> Define functions and associated concepts such as domain and range <b>3.6</b> Identify 1-1 onto functions	CO1 CO3 CO4	5-8	<b>Relations and Functions</b> <ul style="list-style-type: none"> <li>Set Partitions</li> <li>Relations and Types of Relations</li> <li>Equivalence Relations and the Induced Partition</li> <li>Functions: Definition, Domain and Range</li> <li>One to one and Onto Functions</li> </ul>	-Synchronous lecture -clarifying and addressing student question	Answer workbook examples and practice exercises	-Text/Workbook Worksheets -Powerpoint Presentation	Practice Exercises Problem Set Major Exam [1] [2]
<b>4.1</b> Discuss binary operations <b>4.2</b> Give examples of binary relations <b>4.3</b> Prove binary operation and its special cases	CO3	8-9	<b>Binary Operations</b> <ul style="list-style-type: none"> <li>Definition and Examples of Binary</li> <li>Commutative and Associative Binary Operations</li> </ul>	-Synchronous lecture -clarifying and addressing student questions	Answer workbook examples and practice exercises	-Text/Workbook Worksheets -Powerpoint Presentation	Practice Exercises Quiz [1] [2] [3]
<b>All ILOs covered in Midterm</b>			<b>Week 10: MIDTERM EXAMINATION</b>				
<b>5.1</b> Define and write permutations <b>5.2</b> Compute permutation inverses and products <b>5.3</b> Identify symmetries of n-gons.	CO1 CO2	11-12	<b>Permutation</b> <ul style="list-style-type: none"> <li>Definition and Notations</li> <li>Permutation Inverses and Products</li> <li>Symmetries of a regular n-gon</li> </ul>	-Synchronous lecture	Answer workbook examples and practice exercises	-Text/Workbook Worksheets -Powerpoint Presentation	Practice Exercises Quiz

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5.4 identify permutation orbits & cycles			Orbits and Cycles	-clarifying and addressing student question					
6.1 define group and demonstrate understanding of group axioms	CO1 CO3	13-15	Groups	-Synchronous lecture	Answer workbook examples and practice exercises	-Text/Workbook Worksheets	Practice Exercises Quiz	1]	
6.2 Prove group axioms			▪ Definition and Group Axioms	-clarifying and addressing student question		-Powerpoint Presentation	Problem Set	[2]	
6.3 Construct finite group tables			▪ Examples and Non-Examples						[4]
6.4 Identify classic groups and their properties			▪ Commutative or Abelian Group						
7.1 Identify subgroups	CO2 CO3	16-17	Subgroups and Cyclic Groups	-Synchronous lecture	Answer workbook examples and practice exercises	-Text/Workbook Worksheets	Practice Exercises Quiz		
7.2 Compute integral powers and multiples			▪ Definition and Notations	-clarifying and addressing student question		-Powerpoint Presentation	Major Exam		
7.3 Identify order of an element			▪ Integral Powers and Multiples						
7.4 Identify cyclic groups			▪ Order of an Element						
All ILOs covered in the Course		18	Cyclic Group						
FINAL EXAMINATION									

\* any interaction, course, program, or other experience in which learning takes place (<https://www.edglossary.org/learning-experience/>).

#### Textbook/References

- [1] USM Student Manual
- [2] Workbook on Abstract Algebra
- [3] Fraleigh, J. 2017. A First Course in Abstract Algebra Free Online
- [4] Bloch, Norman, 1988. Abstract Algebra with Applications. Prentice-Hall, Inc., USA
- [5] Gallian, Joseph, 1991. Contemporary Abstract Algebra, D.C. Heath and Company, USA
- [6] Kwong, H. (2019). A spiral Workbook for Discrete Mathematics – Indirect Proofs. Retrieved from <https://math.libretexts.org>.
- [7] Herstein, I. 1986. Abstract Algebra, Macmillan New York, USA.
- [8] Hungerford, T. 1974. Algebra. Holt, Rhineheart and Winston, Inc., USA
- [9] Kleiner, I. 1986. The Evolution of Group Theory: A Brief Survey. *Mathematics Magazine* 59(4) p. 195-215
- [10] Jacobson, N. (2016). Basic Algebra, Dover Publications, Inc. USA.

#### Life-long Learning Opportunity

Gain deeper understanding of mathematical procedures and apply to other related disciplines.





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Course Outcomes (CO)		Course Evaluation		
		Assessment Task Addressing CO	Weight (%)	Satisfactory Rating
CO1: Interpret, and use the vocabulary, symbolism, and definitions basic to abstract algebra.		Practice Exercises	5	60%
		Quizzes	15	
CO2: Perform manual or technology-aided operations under different algebraic structures.		Practice Exercises/Problem Set	5	60%
		Quizzes	15	
CO3: Justify statements and arguments involving mathematical concepts and algebraic structures.		Problem Set	10	60%
		Major Exam	20	
CO4: Strengthen perseverance and tenacity through problem solving.		Problem Set	10	60%
		Major Exam	20	

Grading System	
<b>Midterm Grade</b> Quizzes-----30% Practice Exercises/Problem Set-----30% Midterm Exam-----40%	<b>Final Grade</b> 50% Midterm Grade+50% Final Term Grade
<b>Final Term Grade</b> Quizzes-----30% Practice Exercises/Problem Set-----30% Final Exam-----40%	<b>Passing Grade</b> 75%





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#### Classroom Policies

- Attendance and active participation in classes is highly encouraged.
- Assignments should be submitted and examinations must be taken within the specified period.
- Special exams shall only be administered within a maximum of one week after the conduct of exam and for valid reasons such as illness or poor internet connectivity.
- Anyone who caught cheating or plagiarizing (in any form), both the cheater and the collaborator will get a failing grade in a subject. We should not neglect the values that the students need to possess. Honesty is a must and should be always practiced.
- Always be polite and direct when sending your concerns through texts or emails.
- Post only questions and comments relevant to the class or topic under discussion in the group chat.
- A grade of INC shall be given only to those who passed the course but failed to submit other requirements before the deadline.

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