UNIVERSITY OF SOUTHERN MINDANAO

Course Syllabus for Discrete Mathematics

Course Number	CpE 04	Rev. No.	3	Page 1 of 11

EFFECTIVE DATE	REV. NO.	REVISION TYPE	CHANGE DESCRIPTION	PAGE AFFECTED	ORIGINATOR
February 12, 2024	3	Partial	Revised updating the course number, teaching and learning activities, learning materials and assessment tasks	ALL	Jeannalen P. Lunod
January 31, 2022	2	Partial	Revised updating list of references and suggested readings	ALL	Jeannalen P. Lunod
February 15, 2021	1	Partial	Revised for Flexible Learning	ALL	Jeannalen P. Lunod
January 13, 2020	Ø	New	Newly established in accordance to the Quality Management System Requirements	ALL	Jeannalen P. Lunod

Author:	Reviewer:	Verifier:	Validator:	Final Approver:	DCC USE ONLY
JEANNALEN P. LUNOD Faculty	SHYRILL D. OGOC Subject Expert	FLOREEY MAE F. PASCUA Department Chairperson	MARICEL G. DAYADAY Dean	MARCOS F. MONDERIN OIC-Vice President for Academic Affairs	DOCUMENT CONTROL INDICATOR MASTER 2024.01.29 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[M1], promote harmony among the diverse cultures[M2] and improve quality of life[M3] through instruction, research, extension and resource generation in Southern Philippines.
Core Values	**G**-Goodness, **R**-Responsiveness, **E**-Excellence, **A**-Assertion of Right and **T**-Truth
USM Quality Policy Statement	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. 1. Establish key result areas and performance indicators across all mandated functions; 2. Implement quality educational programs; 3. Guarantee competent educational service providers; 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; 5. Facilitate transfer of technologies generated from research to the community for sustainable development; 6. Strengthen relationship with stakeholders; 7. Sustain good governance and culture, sensitivity; and 8. Comply with customer, regulatory and statutory requirements.
Goals of the College	The USM College of Engineering and Computing aims to provide quality education on the various fields of engineering and related technologies; meet the community's trained manpower in engineering and information technology in various technical and managerial capacities; and conduct researches and extension activities geared towards the amelioration of technological, environmental and human resource problems in the region and the country at large.
Department Objectives	The program aims to prepare the students for professional career who will effectively and efficiently meet the scientific, technological and various needs of business, industries and communities in the global economy. Aside from their professional knowledge and skills, the graduates must also possess strong foundation in the physical and basic engineering sciences as well as in human relations to enable them to meet the challenges being brought about by the rapid technological developments.

PROGRAM INFORMATION					
Degree Program	**BS Computer Engineering**	CHED CMO Reference	**87 S2017**	BOR Approval	**BOR Res. 118 s. 2018**

COURSE DETAILS					
Course Title	**Discrete Mathematics**				
Course Number	**CpE 04**		Curriculum Component	**C**	
Credit (--Unit)	**3-0-3**	LECTURE(Unit-Hours)	**3-3**	LABORATORY(Unit-Hours)	**0-0**
Prerequisites	**Calculus I (EngMath 02)**	Co-requisites	**None**	Year Level/Semester Offered	**1st Year - Second Semester**
Course Descriptio72n	This course deals with logic, sets, proofs, growth of functions, theory of numbers, counting techniques, trees and graph theory.				
Faculty in charge					
Consultation Hours			Contact Information		

PROGRAM EDUCATIONAL OBJECTIVES (PEO)		MISSION		
In 3-5 years, the **BSCpE** graduates of USM shall:		*M1*	*M2*	*M3*
PEO 1	Provide leadership in the field of computer engineering 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		✓	✓
PEO 6	Be a creative, innovative and responsible computer engineer adhering, but not limited to, professional, moral and legal standards	✓	✓	✓

PROGRAM OUTCOMES (PO)		PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
Upon graduation, the University of Southern Mindanao students must be able to:							
a)	understand at least one specialized field of Computer Engineering practice	✓	✓			✓	✓
b)	communicate effectively		✓			✓	
c)	function on multidisciplinary teams			✓	✓		
d)	apply professional and ethical responsibility	✓	✓			✓	

e)	apply knowledge of contemporary issues		✓				✓
f)	design and conduct experiments, as well as to analyze and interpret data	✓	✓				
g)	apply knowledge of mathematics and science to solve engineering problems	✓	✓	✓			
h)	design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards	✓	✓				
i)	identify, formulate, and solve engineering problems		✓				
j)	recognize the need for, and an ability to engage in life-long learning					✓	
k)	use techniques, skills, and modern engineering tools necessary for engineering practice		✓				
l)	apply knowledge of engineering and management principles as a member and leader in a team, to manage projects and in multidisciplinary environments	✓		✓	✓		✓
m)	identify the impact of engineering solutions in a global, economic, environmental, and societal context	✓	✓	✓			✓

COURSE OUTCOMES (CO)		POa	POb	POc	POd	POe	POf	POg	POh	POi	POj	POk	POl	POm
Upon passing this course, the students must be able to:	**Course Alignment to Program Outcomes**													
CO1	Demonstrate knowledge on the foundations of discrete mathematics including algorithms, integers and matrices							I						
CO2	Apply counting techniques in calculation of discrete probabilities and use relations to solve problems							I						
CO3	Use trees and graph theory in dealing with discrete mathematics							I						

* ***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) *By the end of the learning experience*, students must be able to:*	Aligned to CO:	Time Frame *(Week)*	Course Content *(Topics)*	Teaching & Learning Activities (TLA)		Learning Materials	Assessment Tasks (AT)	Suggested Readings
				Teaching Activities	Learning Activities			
1.1 restate the classroom and university policies **1.2** recall the overview of the course and the grading system			• Classroom and University Policies • Course Overview and Grading System	• Orientation	• Reading	• USM Code • Student Manual • Course Syllabus		[1] [2] pp. 12-13
1.3 define propositions **1.4** determine the truth values of the propositions **1.5** construct compound propositions using the negation operator and the logical operators **1.6** express compound proposition as an English sentence **1.7** write the propositions using letters and logical connectives **1.8** express implication and biconditional in different ways **1.9** construct a truth table of a compound proposition **1.10** write the converse, contrapositive and inverse of an implication	**CO1**	**1**	**Logic, Sets, Proofs and Functions** o Logic	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[4] pp. 4-14 pp. 197-228 [5] pp. 1-17
1.11 show that two propositions are logically equivalent **1.12** explain the classification of compound propositions	**CO1**	**2**	o Propositional Equivalences	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[4] pp. 197-228 [5] pp. 26-40

according to their possible truth values								
1.13 determine the truth values of propositional function P at x and universal and existential quantifications	**CO1**	**3**	○ Predicates and Quantifiers	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[4] pp. 15-17 [5] pp. 40-60
1.14 define sets **1.15** list the members of a set **1.16** use set builder notation to give a description of a set **1.17** determine whether a given is an element of the set **1.18** determine the cardinality of a set **1.19** determine the power set of a given set **1.20** obtain the Cartesian product of two or more sets **1.21** perform operations on set **1.22** draw the Venn diagram of a given set **1.23** solve problems using Venn diagram	**CO1**	**4**	○ Sets ○ Set Operations	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[4] pp. 24-38 [5] pp. 121-146
2.1 define algorithm **2.2** identify the properties of algorithm **2.3** demonstrate the use of searching and sorting algorithms **2.4** use Caesar Cipher to encrypt and decrypt messages	**CO1**	**5**	**Algorithms, Integers and Matrices** ○ Growth of Functions ○ Complexity of Algorithms	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[5] pp. 201-244
2.5 express integers in different	**CO1**	**6**	○ Number Theory	• Lecture	• Reading	• Textbook (E-	• Quiz	[5] pp. 260-271

number systems **2.6** convert a given integer from one number system into another				• Classroom Discussion	• Exercises	• book) • Lecture slides	• Assignment	
2.7 define matrices **2.8** determine the size of a given matrix **2.9** perform operations on matrices **2.10** determine if product of two matrices are defined	**CO1**	**7**	○ Matrices - Operations on matrices	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[5] pp. 188-195
2.11 find the inverse of a matrix	**CO1**	**8**	○ Matrices - Inverse of a matrix	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[5] pp. 188-195
All ILOs covered in Midterm		**9**	**MIDTERM EXAMINATION**					
3.1 use the product rule and sum rule to solve many different counting problems **3.2** apply the Pigeonhole principle in solving some counting problems	**CO2**	**10**	**Counting Techniques** ○ The Basics of Counting ○ The Pigeonhole Principle	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[4] pp. 57-133 [5] pp. 405-428
3.3 apply permutations and combinations for counting unordered selections of distinct objects and the ordered arrangement of objects of a finite set respectively	**CO2**	**11**	○ Permutations and Combinations	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[4] pp. 57-133 [5] pp. 428-437
4.1 define relation **4.2** write the relation as a set of ordered pairs **4.3** write the relation as a table **4.4** draw the digraph of the relation **4.5** write the relation on a set	**CO2**	**12**	**Relations** ○ Relations as a set of ordered pairs ○ Digraph of a relation	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[5] pp. 599-665

defined by a rule **4.6** find the domain and range of a relation								
4.7 list the elements of the inverse of a relation **4.8** identify the property/ies of a relation **4.9** find the composition of the given two relations	**CO2**	**13**	○ Properties of relations ○ Inverse of a relation ○ Composition of the given two relations	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[5] pp. 599-665
5.1 identify the type of graph **5.2** identify graph model	**CO3**	**14**	**Graph Theory** ○ Introduction to Graphs	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[4] pp. 231-246 [5] pp. 673-770
5.3 solve shortest-path problems in undirected weighted graphs	**CO3**	**15**	○ Shortest-Path Problems	• Lecture • Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[4] pp. 231-246 [5] pp. 673-770
6.1 define tree **6.2** identify which of the given graphs are trees **6.3** familiarize the terminology for trees **6.4** draw the subtree of a tree **6.5** define rooted tree **6.6** describe a variety of models based on trees **6.7** construct a binary search tree **6.8** apply binary search trees, decision trees and game trees in solving problems	**CO3**	**16**	**Trees** ○ Introduction to Trees ○ Applications of Trees	• Lecture Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz Assignment	[4] pp. 247-257 [5] pp. 781-840
7.1 describe the sentences of a formal language using a grammar **7.2** familiarize the terminology for grammar	**CO3**	**17**	**Introduction to Modeling Computation** ○ Languages and Grammars ○ Finite-State Machines with Output	• Lecture Classroom Discussion	• Reading • Exercises	• Textbook (E-book) • Lecture slides	• Quiz • Assignment	[5] pp. 885-937

7.3 find the language generated by a phrase-structure grammar **7.4** identify the type of phrase-structure grammars **7.5** construct a derivation tree **7.6** define finite-state machine with output **7.7** construct the state diagram for the finite-state machine with the given state table **7.8** construct the state table for the finite-state machine with the given state diagram **7.9** define finite-state machine with no output **7.10** construct the state diagram for the finite-state automaton **7.11** determine the language recognized by the given finite-state automata			○ Finite-State Machines with No Output					
All ILOs covered in the Course		**18**	**FINAL EXAMINATION**					

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

Textbook/References

[1] USM Code
[2] Student Manual
[3] Johnsonbaugh, R. (2018). *Discrete Mathematics 8th Edition.* Pearson.
[4] Levin, O. (2016). *Discrete Mathematics: An Open Introduction 3rd Edition.*
[5] Rosen, K.H. (2019). *Discrete Mathematics and Its Applications 8th Edition.* New York: McGraw-Hill.

Life-long Learning Opportunity

Course Evaluation

Course Outcomes (CO)	Assessment Task Addressing CO	Weight (%)	Satisfactory Rating	Target Standard
CO_1 Demonstrate knowledge on the foundations of discrete mathematics including algorithms, integers and matrices	Quiz	35	75	60% of the class obtained satisfactory rating
	Exam	45		
	Assignment	20		
CO_2 Apply counting techniques in calculation of discrete probabilities and use relations to solve problems	Quiz	35	75	60% of the class obtained satisfactory rating
	Exam	45		
	Assignment	20		
CO_3 Use trees and graph theory in dealing with discrete mathematics	Quiz	35	75	60% of the class obtained satisfactory rating
	Exam	45		
	Assignment	20		

Grading System

MIDTERM/FINAL TERM GRADE

Attendance 10%
Quizzes 30%
Assignments 20%
Exam 40%

FINAL GRADE = 50% Midterm + 50% Final term

PASSING GRADE: 75 (3.00)

Classroom Policies

CLASS POLICIES

- Attendance is counted from the first regular class meeting.
- Student must wear proper uniform while attending classes.
- Cheating is strictly prohibited. Any form of dishonesty shall be dealt with accordingly. Honesty is called for at all times.
- Base-40 grading policy should be observed.
- Cellphones must be put into silent mode so as not to distract the class

POLICY ON DISHONEST ACADEMIC PRACTICE

The University of Southern Mindanao does not tolerate dishonest academic practice. There are many forms of dishonesty in academic practice. Some are intentional, but some occur unintentionally due to lack of knowledge and understanding of what is meant by them. In all cases, dishonest academic practice is a serious matter, because it undermines the respect and trust which people view as academic endeavor and achievement.

Among others, dishonest practice includes:

- Plagiarism. Plagiarism is using others' ideas and words without clearly acknowledging the source of that information. To avoid plagiarism, you must give credit whenever you use, another person's idea, opinion, or theory; any facts, statistics, graph, drawings – any pieces of information – that are not common knowledge; quotations of another person's actual spoken or written words; or paraphrase of another person's spoken or written words (https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism).
- Collusion. The submission of work done in whole or in part with another person or persons but submitted as if it had been completed by the named author alone (or joint authors if a group item of work).
- Ghost writing. The use of another person (with or without any form of payment) to prepare all or part of an item of work submitted by the group for assessment.
- Fabrication of data. The presentation of data, which are not obtained through experimentation or research.

Plagiarism can be avoided by familiarizing yourself with the material referred to in Point 1. Plagiarism can be readily detected, and the penalties are severe. It is your responsibility to ensure that you know how to avoid it.

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

MONITORING OF DELIVERY OF INSTRUCTION

Course Title	Discrete Mathematics			Semester/Academic Year		
Course Number	CpE 04	Faculty in charge		Room Number		Day/Time	

Time Frame	Topics	CO Addressed	Target week/date	Delivery monitoring (Actual date)	Remarks
Week 1	Orientation on Classroom and University Policies as well as Course Overview and Grading System **Logic, Sets, Proofs and Functions** o Logic	CO1			
Week 2	o Propositional Equivalences	CO1			
Week 3	o Predicates and Quantifiers	CO1			
Week 4	o Sets o Set Operations	CO1			
Week 5	**Algorithms, Integers and Matrices** o Growth of Functions o Complexity of Algorithms	CO1			
Week 6	o Number Theory	CO1			
Week 7	o Matrices - Operations on matrices	CO1			
Week 8	o Matrices - Inverse of a matrix	CO1			
Week 9	**MIDTERM EXAM**				

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MONITORING OF DELIVERY OF INSTRUCTION

Week 10	**Counting Techniques** o The Basics of Counting o The Pigeonhole Principle	CO2			
Week 11	o Permutations and Combinations	CO2			
Week 12	**Relations** o Relations as a set of ordered pairs o Digraph of a relation	CO2			
Week 13	o Properties of relations o Inverse of a relation o Composition of the given two relations	CO2			
Week 14	**Graph Theory** o Introduction to Graphs	CO3			
Week 15	o Shortest-Path Problems	CO3			
Week 16	**Trees** o Introduction to Trees o Applications of Trees	CO3			
Week 17	**Introduction to Modeling Computation** o Languages and Grammars o Finite-State Machines with Output o Finite-State Machines with No Output	CO3			
Week 18	**FINAL EXAM**				