EFFECTIVE DATE	REV. NO.	REVISION TYPE	CHANGE DESCRIPTION	PAGE AFFECTED	ORIGINATOR
August 5, 2022	Ø	New	Newly established for BS Applied Mathematics in accordance to the Quality Management System Requirements	ALL	Leonard M. Paleta, PhD
		ELECTRONICALLY RELEASED 2025.07.09			

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Author:	Reviewer:	Verifier:	Validator:	Final Approver:	DCC USE ONLY
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LEONARD M. PALETA, PhD Faculty	PHILIP LESTER P. BENJAMIN, PhD Subject Expert	JEANETH R. LICAROS, PhD Department Curriculum Coordinator	JONALD L. PIMENTEL, PhD Dean	GEOFFRAY R. ATOK, PhD Vice President for Academic Affairs	MASTER COPY
Date: 2022.08.01	Date: 2022.08.02	Date: 2022.08.03	Date: 2022.08.04	Date: 2022.08.05	2022.08.1

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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	Competent professionals who will be leaders in the fields of agriculture, industry, rural and economic development, science and technology, and education, and thus help improve the quality of life of the people in Southern Philippines. Updated and innovative professionals equipped in the state-of-the-art and cutting- edge technologies of their respective fields of specialization
Department Objectives	The Graduate School aims to produce MS/MA and PhD/EdD graduates who can meet the highest standards of performance in their various professions whether in the areas of Research, Instruction, Extension, and Resource Generation; at par if not well above average in knowledge, skills and values with other professionals and colleagues in the specific disciplines where they belong as offered by the Graduate School, among others: Education, Agriculture, Extension, Public affairs management, Mathematics, Industrial Arts, Language Teaching, and Rural Development; who can be authorities or expert of their own respective disciplines and can thus be depended upon by the community and clientele they serve; who can generate new knowledge, innovations, technologies, and strategies through research along their field of expertise;

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who can establish, demonstrate, or show case their own leadership, new technologies, innovations, and strategies through outputs as in but not limited to invention, production, project conduct or implementation, and publication.

PROGRAM INFORMATION

Degree Program	**Bachelor of Science in Applied Mathematics**	CHED CMO Reference	**48 series of 2017**	BOR Approval	**BOR Resolution No. 24 series of 2020**

COURSE DETAILS

Course Title	**Graph Theory and Applications**			
Course Number	**Math 314**	Curriculum Component		
Credit (--Unit)	3	LECTURE (Unit-Hours)	3	LABORATORY (Unit-Hours)	0
Prerequisites		Co-requisites		Year Level/Semester Offered	3rd yr / 1st Semester
Course Description	Fundamental concept s in graph theory. Graphs, subgraphs, adjacency, connectedness and vertex traversability. Planar graphs and special classes of graphs Applications of graph Theory.			
Faculty in charge				
Consultation Hours		Contact Information		

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

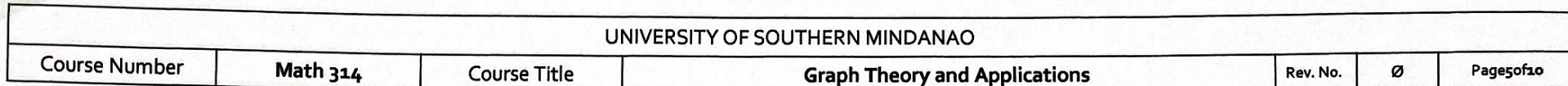| In 3-5 years, the graduates of USM shall:		M1	M2	M3
PEO 1	Provide leadership in various development programs both public and private	✓		
PEO 2	Equip with technical, conceptual and human resource skills	✓		✓
PEO 3	Pursue entrepreneurial activities	✓		✓
PEO 4	Able to adapt to diverse culture		✓	
PEO 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)	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8	PEO9	PEO10	...
Upon graduation, the University of Southern Mindanao students must be able to:											
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.		✓									

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.

PROGRAM OUTCOMES (PO)	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8	PEO9	PEO10	...
Upon graduation, the University of Southern Mindanao BS Applied Mathematics students must be able to:											
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.		✓									
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		✓									

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Course Number	Math 314	Course Title	Graph Theory and Applications	Rev. No.	Ø	Page5of10

		✓	
q.)	Gain mastery in the cores areas of mathematics: algebra, analysis, and geometry.	✓	
r.)	Demonstrate skills in pattern recognition, generaliztion, abstraction, critical analysis, synthesis, problem-solving and rigorous argument.	✓	
s.)	Develop 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.	✓	
t.)	Appreciate the concept and role of proof and reasoning and demonstrate knowledge in reading and writing mathematical proofs.	✓	
u.)	Make and evaluate mathematical conjectures and arguments and validate their own mathematical thinking.	✓	
v.)	Communicate mathematical ideas orally and in writing using clear and precise language.		

COURSE OUTCOMES (CO)	POa	POb	POc	POd	POe	POf	POg	POh	POi	POj	POk	POl	POm	POn	POo	POp	POq	POr	POs	POt	POu	POv	POw	POx	POy	POz
Upon passing this course, the students must be able to: **Course Alignment to Program Outcomes**																										
CO 1 Present, discuss and prove some fundamental concepts in graph theory and its applications	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I		I	I	I	I	I			
CO 2 Define, discuss the properties, and give examples of graphs basic properties and parameters	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I		I	I	I	I	I			
CO 3 Discuss more properties of graphs and connectivity	I	I	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E			
CO 4 Present and discuss the graph traversavility and planar graphs	I	I	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E			

*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)
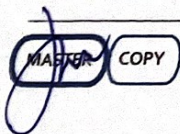
COURSE LEARNING PLAN

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) Teaching Activities	Learning Activities	Learning Materials	Assessment Tasks (AT)	Suggested Readings
1.1 Explain the vision, mission, UQPS of the uiversirt		1	Orientation on Classroom and University Policies as well as	Orientation Lecture/Discussion	Reading; Assignment	Computer; Chalkboard	Recitation	[1]

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Course Number	Math 314	Course Title	Graph Theory and Applications	Rev. No.	Ø	Page6of10

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) Teaching Activities	Learning Activities	Learning Materials	Assessment Tasks (AT)	Suggested Readings
1.2 Explain the goals, and objectives of the college 1.3 Explain the Program Educational Objectives, Students Outcomes, and Course Outcomes			**Grading System** • Discussion on PEO, SO and CO					
2.1 Discuss the Fundamental Concepts 2.2 Prove some fundamental theorems	CO1	2	**Fundamental Concepts** • An overview of Graph Theory • Definition of a graph and basic examples • Graphs classifications (Simple, Multigraph, etc) • Directed graphs (weighted and unweighted) • Some applications of graph theory	Lecture/Video Presentation using google meet/zoom and addressing student questions	Reading; Assignment and Solving	Computer; Chalkboard	Assignments, Quizzes, Exams and Reflective paper	[2]p5-35 [3]p20-47 [4]p3-33 [5]p5-15 [6]p5-24 [7][8]p10-20
3.1. Discuss and draw some special classes of graphs 3.2 Discuss n-partite graphs and its properties 3.4 Present and prove some theorems on graph isomorphisms 3.5. Discuss the properties of regular and prove some basic theorems	CO1	3-4	Basic graph parameters and degrees • Nontrivial graph • Order and size of a graph • Neighborhood (open and close) of a graph • Leaf, isolated vertex • Minimum and maximum degrees • Path, Walks, and Cycles • Complete, Bipartite and Multipartite Graphs	Lecture/Video Presentation using google meet/zoom and addressing student questions	Reading; Assignment and Solving	Computer; Chalkboard	Assignments, Quizzes, Exams and Reflective paper	[2][3]p 35-70 [4] [5] [6] [7][8]p21-45

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COURSE LEARNING PLAN

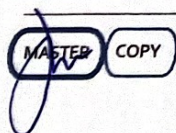| Intended Learning Outcomes (ILO) By the end of the learning experience*, students must be able to:	Aligned to CO:	Time Frame (Week)	Course Content (Topics)	Teaching & Learning Activities (TLA) Teaching Activities	Teaching & Learning Activities (TLA) Learning Activities	Learning Materials	Assessment Tasks (AT)	Suggested Readings
4.1 Discuss some important elementary graph properties 4.2 Give the degree sequences of a graph 4.3 State and prove the handshaking Lemma 4.4 Discuss subgraphs and give examples 4.5 Given a graph, give its complement, cliques and independent sets	CO2	5-6	• Regular graphs **Elementary Graph Properties** • Degree sequences • Handshaking Lemma • Subgraphs (proper, induced and spanning) • Graph complement, cliques and independent set	Lecture/Video Presentation using google meet/zoom and addressing student questions	Reading; Assignment and Solving	Computer; Chalkboard	Assignments, Quizzes, Exams and Reflective paper	[2][3] [4] [5] [6] [7][8]p45-100
5.1 Discuss and explore representations of graphs 5.2 Give some ways of proving or showing that two graphs are isomorphic	CO2	7-8	**Graph representations and Isomorphisms** • Adjacency List • Adjacency matrix • Incidence Matrix • Graph isomorphisms	Lecture/Video Presentation using google meet/zoom and addressing student questions	Reading; Assignment and Solving	Computer; Chalkboard	Assignments, Quizzes, Exams and Reflective paper	[2][3] [4] [5] [6] [7][8]p101-135
All ILOs covered in Midterm		9	**MIDTERM EXAMINATION**					
6.1 Discuss and explore more graph properties 6.2 Given a graph, compute distance, diameter, radius, and its circumference 6.3 Explore properties of trees and forests	CO3	10-11	**More graph properties** • Distance in graphs • Diameter, radius, circumference and girth • Trees and forests	Lecture/Video Presentation using google meet/zoom and addressing student questions	Reading; Assignment and Solving	Computer; Chalkboard	Assignments, Quizzes, Exams and Reflective paper	[2][3] [4] [5] [6] [7][8]p135-155
6.1 Define, discuss, explore and give examples of connectivity in graphs			**Graph Connectivity** • Definition of a connected graph	Lecture/Video Presentation using google meet/zoom and addressing	Reading; Assignment and Solving	Computer; Chalkboard	Assignments, Quizzes, Exams and Reflective paper	[2][3] [4] [5] [6]

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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) Teaching Activities	Learning Activities	Learning Materials	Assessment Tasks (AT)	Suggested Readings
	CO3	12-13	• k-connected graph • Cut vertex • Cute edge (bridge) • Cut set of a graph • Edge connectivity • Vertex connectivity	student questions				[7][8]p156-170
7.1 Discuss concepts on transversability 7.2 Discuss and prove some standard theorems on Hamiltonian and Eulerian graphs	CO4	14-15	• Graph Traversability • Euler's path • Euler's circuit • Euler's Circuit Theorem • Hamiltonian Graph • Hamiltonian Path • Hamiltonian Cycle	Lecture/Video Presentation using google meet/zoom and addressing student questions	Reading; Assignment and Solving	Computer; Chalkboard	Assignments, Quizzes, Exams and Reflective paper	[2][3] [4] [5] [6] [7][8]p171-180
8.1 Discuss, draw and give examples of planar graphs 8.1 State and apply Euler's formula 8.2 State and apply Kuratowski's Theorem	CO4	16-17	• Planar Graph • Definition of a planar Euler's Formula Kuratowski's Theorem	Lecture/Video Presentation using google meet/zoom and addressing student questions	Reading; Assignment and Solving	Computer; Chalkboard	Assignments, Quizzes, Exams and Reflective paper	[2][3] [4] [5] [6] [7][8]p181-190
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 Student Manual

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Textbook/References

[2] Bondy, J.A. & Murty,U.S.R. (2008) Graph Theory. Graduate Text in Mathematics.Springer. DOI: 10.1007/978-1-84628-970-5

[3]Chartrand, G.,Lesniak,L.,& Zhang, P.(2016). Graphs and Digraphs, 6th Ed.,CRC Press, USA.

[4]Chartrand, G & Zhang,P. (2012). A First Course in Graph Theory. Dover Publications, USA.

[5] Harary,F. (2018). Graph Theory (reprint). CRC Press, USA.

[6]Saoub, K.R. (2018). A Tour Through in Graph Theory. CRC Press, USA

[7]Saoub, K.R.(2021). Graph Theory: An Introduction to Proofs, Algorithms, and Applications. CRC Press, USA.

[8]West, D.B. (2002). *Introduction to Graph Theory, 2nd Ed.* Pearson, USA.

Life-long Learning Opportunity

Appreciate and apply the concepts of graph theory in real life situations like chemical graph theory, biological networks, shortest path algorithms, traffic management systems, scheduling and so on.

Course Evaluation

Course Outcomes (CO)	Assessment Task Addressing CO	Weight (%)	Satisfactory Rating	Target Standard
CO 1: Present,discuss and prove some fundamental concepts in graph theory and its applications	Quizzess/Assignments/Others	60%		
	Major exam	40%		
CO2: Define, discuss the properties , and give examples of graphs basic properties and parameters	Quizzess/Assignments/Others	60%		
	Major exam	40%		
CO 3:Discuss more properties of graphs and connectivity	Quizzess/Assignments/Others	60%		
	Major exam	40%		
CO 4:Present and discuss the graph traversavility and planar graphs	Quizzess/Assignments/Others	60%		
	Major exam	40%		

Grading System

Midterm Grade

Quizzes/Summative Exams------------------------------40%

Midterm Exam/USM Online Exam---------------------40%

Assignments/Exercises---------------------------------20%

Final Grade

50% Midterm Grade+50% Final Term Grade

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Grading System

Final Term Grade
Quizzes/Summative Exams---------------------------------40%
Midterm Exam/USM Online Exam--------------------40%
Assignments/Exercises--------------------------------20%

Passing Grade
60%

Classroom Policies

Come to class prepared for recitation, class discussions, or unannounced quizzes always. Demonstrate personal responsibility by obtaining notes and finding out any instructions/important announcements given on the class period missed.

2. Absence is not a right, nor a privilege. The University Code on absence and tardiness applies. 20% of the total class hours means you are DROPPED from the course. Absences can be excused only after presenting official documents.

3. All submissions must be your original work. Cite sources properly. Plagiarism and any form of academic cheating get a corresponding grade of 5.0 (Failed) and can be grounds for suspension or expulsion.

4. During online class, students are expected to:
a.   Show up on a scheduled time and wait to be admitted into the class.
b.   Be always respectful. If your video is on, avoid hand gestures or inappropriate language.
c.   Stay on mute. Click a raise hand button if you have a question or something to share.
d.   Stay focused and on task so you don't miss anything the speaker says.
e.   Class participation is highly encouraged.

5. Consultation: You can approach your class mayor for your concerns so he/she will relay them once to your professor

6. All information and queries regarding our class will be posted in our official group chat or facebook group. Refrain from posting unrelated topics in these platforms as these will take up space in the messenger box and will make it difficult to backread important messages.

7. Observe proper decorum when sending messages to your professors.

8. Avoid sending messages online outside office hours or during evening.

9. All submissions must be in google forms or thru USM email. Submissions made outside will not be accepted.

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