UNIVERSITY OF SOUTHERN MINDANAO

COURSE SYLLABUS for Operations Research I

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EFFECTIVE DATE	REV. NO.	REVISION TYPE	CHANGE DESCRIPTION	PAGE AFFECTED	ORIGINATOR
January 16, 2023	Ø	New	Newly established for BS Applied Mathematics program in accordance to the Quality Management System.	All	Leonard M. Paleta/ Lawton John A. Yabes
			ELECTRONICALLY RELEASED 2025.07.09		

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Author:	Reviewer:	Verifier:	Validator:	Final Approver:	DCC USE ONLY
LEONARD M. PALETA, PhD/ LAWTON JOHN A. YABES Course Developer	ANNA JEAN S. GARCIA, MAS Subject Expert	JEANETH R. UCAROS, PhD Department Curriculum Coordinator	PHILIP LESTER P. BENJAMIN, PhD CSM Dean	GEOFFRAY R. ATOK, PhD Vice President for Academic Affairs	DOCUMENT CONTROL INDICATOR
Date: 2023.01.09	Date: 2023.01.09	Date: 2023.01.10	Date: 2023.01.11	Date: 2023.01.12	MASTER 2023.01.16 / COPY

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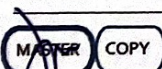| INSTITUTIONAL POLICIES	
Vision	Quality and relevant education for its clientele to be globally competitive, culture sensitive and morally responsive human resources for sustainable development.
Mission	Help accelerate socio-economic development[M1], promote harmony among the diverse cultures[M2] and 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	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. 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. 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. 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.
Department Objectives	The Department of Mathematics and Statistics aims to: 1. produce students with mastery in the core areas of mathematics and statistics, including algebra, analysis, and geometry; 2. develop students' skills in pattern recognition, generalization, abstraction, critical analysis, synthesis, problem-solving and rigorous argument; 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 4. develop students' skills in creating and evaluating mathematical conjectures and arguments, and in validating their own mathematical thinking.

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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. 24, s 2020

COURSE DETAILS

Course Title	Operations Research I			
Course Number	Math 222b		Curriculum Component	Major subject
Credit (--Unit)	3 Units	LECTURE (Unit-Hours)	3 Units - 3 Hours	LABORATORY (Unit-Hours)	0 Units - 0 Hours
Prerequisites	Linear Algebra	Co-requisites	None	Year Level/Semester Offered	3rd year / Second Semester
Course Description	This course is an introduction to linear programming. It covers basic concepts, problem formulation, graphical solution for two-variable problems, simplex algorithm and other algorithms for special LP problems, duality and sensitivity analysis. In-class lectures and discussions are supplemented by computer hands-on sessions.			
Faculty in charge				
Consultation Hours			Contact Information	

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PROGRAM EDUCATIONAL OBJECTIVES (PEO)

In 3-5 years, the **BSAM** 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.

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PROGRAM OUTCOMES (PO) Upon graduation, the University of Southern Mindanao **BSAM** students must be able to:	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8	PEO9	PEO10	...
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.) Demonstrate broad and coherent knowledge and understanding in the core areas of physical and natural sciences.		✓									
h.) Apply critical and problem solving skills using the scientific method.		✓									
i.) Interpret relevant scientific data and make judgements that include reflection on relevant scientific and ethical issues.	✓	✓			✓						
j.) Carry out basic mathematical and statistical computations and use appropriate technologies in the analysis of data.		✓			✓						
k.) Communicate information, ideas, problems, and solutions, both orally and in writing, to other scientists, decision makers, and the public.	✓	✓	✓	✓							
l.) Relate science and mathematics to the other disciplines.		✓	✓	✓	✓						
m.) Design and perform safe and responsible techniques and procedures in laboratory or field practices.		✓									
n.) Critically evaluate input from others.		✓		✓							
o.) Appreciate the limitations and implications of science in everyday life.		✓									
p.) Commit to the integrity of data.		✓		✓	✓						
q.) Gain mastery in the cores areas of mathematics: algebra, analysis, and geometry.		✓			✓						
r.) Demonstrate skills in pattern recognition, generalization, 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.	✓	✓									

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.

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
Upon passing this course, the students must be able to: **Course Alignment to Program Outcomes**																						
CO 1 — Determine appropriateness of linear programming (LP) modeling as framework to investigate real-world problems.	I	I	I			I	I	E		E		E										
CO 2 — Develop LP models that consider key elements of real world problems.	I	I	I			I	I	E		E		E										
CO 3 — Solve the models for their optimal solutions	I	I	I			I	I	E		E		E										
CO 4 — Interpret the models' solutions and infer solutions to the real-world problems	I	I	I			I	I	E		E		E										
CO 5 — Illustrate proficiency in the use of the simplex method and its variants and extensions	I	I	I			I	I	E		E		E										
CO 6 — Apply the principle of duality in solving LP problems	I	I	I			I	I	E		E		E										
CO 7 — Demonstrate proficiency in using appropriate mathematical software in solving problems	I	I	I			I	I	E		E		E										
CO 8 — Apply parametric and integer programming whenever appropriate	I	I	I			I	I	E		E		E										
CO 9 — Develop a report that describes the formulation of a model, its solution, and analysis, with recommendations in language understandable to decision makers	I	I	I			I	I	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)

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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
1.1 Explain the vision, mission, UQPS of the University 1.2 Explain the goals and objectives of the college. 1.3 Explain the Program Educational Objectives, Students Outcomes , and Course Outcomes.	CO1	1	**Orientation on Classroom and University Policies as well as Grading System** • **Discussion on PEO, SO and CO**	Orientation Lecture/Discussion	Reading; Assignment	Computer; Chalkboard	Recitation	[1]
2.1 Define systems of linear equations 2.2 Determine the canonical form of a given equation 2.3 Determine the basic solution 2.4 Determine the basic feasible solutions 2.5 Determine the degenerate solutions 2.6 Define and discuss inconsistent systems	CO1, CO2	2	**Review of Linear Algebra** ▪ Systems of linear equations ▪ Canonical forms ▪ Basic solutions ▪ Basic feasible solutions ▪ Degenerate solutions ▪ Inconsistent systems	Lecture/ Video Presentation/addressing students questions	Reading and Solving	Instructional Modules; e-book copy of the references	Assignments Quizzes Exams	[3]pp 10-78
3.1 History of Operations Research 3.2 Definition of Operation Research 3.3 Discuss the Nature and Impact of Operation Research 3.4 Show the applications Operations Research in real life.	CO3, CO4	3-4	**Overview of Operations Research** ▪ Definition of OR ▪ The general optimization problem ○ Survey of applications and introduction to some classical LP models ○ The product mix problem	Lecture/ Video Presentation/addressing students questions	Reading and Solving	Instructional Modules; e-book copy of the references	Assignments Quizzes Exams	[2][3][4]pp79-100[5]p 15-25

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			o The diet problem o The transportation problem o The caterer's problem					

4.1 Define Linear Programming(LP)
4.2 Discuss and make the structure of LP
4.3 Discuss the limitations of LP
4.4 Understand and follow the guidelines on LP Model Formulation
4.5 Discuss the different methods on solving LP problems
	CO5, CO6	5-6	**Linear Programming (LP)**
			▪ Definition of linear programming
			▪ Formulation of verbal problems into LPs
			▪ Assumtions/Limitations:
			  o Proportionality
			  o Additivity
			  o Divisibility
			  o Nonnegativity
			  o Certainty
			  o Single Objectives
				Lecture/ Video Presentation/addressing students questions	Reading and Solving	Instructional Modules; e-book copy of the references	Assignments Quizzes Exams	[2]p 75-101

5.1 Define LP and it's geometry in two variables 5.2 Graph linear inequalities 5.3 Find the feasible region within the graph (e.g. convex polyhedral area) 5.4 Determine the extreme points of the graph 5.5 Define the objective function	CO7, CO8	7-8	**Geometry of LP in two variables** ▪ Graphing of linear inequalities ▪ The feasible region as a convex polyhedral area ▪ Geometric interpretation of convex combination ▪ The extreme points ▪ The objective function as a family of parallel lines	Lecture/ Video Presentation/addressing students questions	Reading and Solving	Instructional Modules; e-book copy of the references	Assignments Quizzes Exams	[2][3][4][5]
All ILOs covered in Midterm			Week 9: MIDTERM EXAMINATION					
	CO9	10-14	**Simplex Method** ▪ Basics of the simplex method ▪ Big M simplex Method ▪ Two phase simplex method ▪ Revised simplex method	Lecture/ Video Presentation/addressing students questions	Reading and Solving	Instructional Modules; e-book copy of the references	Assignments Quizzes Exams	[2][3][4][5]
		15-17	**Duality**	Lecture/	Reading and	Instructional	Assignments	

			- Formulation of the dual problem - Weak and strong duality theorems - Complementary slackness conditions - Karush-Kuhn-Tucker optimality conditions	*Video Presentation/addressing students questions*	*Solving*	Modules; e-book copy of the references	Quizzes Exams	[2][3][4][5]pp 200-241
All ILOs covered in the Course		**18**			**FINAL EXAMINATION**			

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

Textbook/References

[1] USM Student Manual
[2] Murthy, P.R. (2007). Operations Research (2nd ed.). New Delhi.
[3] Sharma, J.K. (2017). Operations Research Theory and Applications (6th ed.). New Delhi.
[4] Taha, H.A. (2017). Operations Research An Introduction (10th ed.). London.
[5] Winston, W.L. (2004). Operations Research Applications and Algorithms (4th ed.). Canada.

Online References

Life-long Learning Opportunity

Apply operations research to real-life scenarios and to other fields such as statistics, computer science, physics, engineering, economics, and social science in order to solve real world problems.

Course Evaluation

Course Outcomes (CO)	Assessment Task Addressing CO	Weight (%)	Satisfactory Rating	Target Standard
CO 1: Determine appropriateness of linear programming (LP) modeling as framework to investigate real-world problems.	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		
CO 2: Develop LP models that consider key elements of real world problems.	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		
CO 3: Solve the models for their optimal solutions	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory

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	Major Exam	40			rating
CO 4: Interpret the models' solutions and infer solutions to the real-world problems	Quizzes/Assignments/Others	60			90% of the class obtained a satisfactory rating
	Major Exam	40	60		
CO 5: Illustrate proficiency in the use of the simplex method and its variants and extensions	Quizzes/Assignments/Others	60			90% of the class obtained a satisfactory rating
	Major Exam	40	60		
CO 6: Apply the principles of duality in solving LP problems	Quizzes/Assignments/Others	60			90% of the class obtained a satisfactory rating
	Major Exam	40	60		
CO 7: Demonstrate proficiency in using appropriate mathematical software in solving problems	Quizzes/Assignments/Others	60			90% of the class obtained a satisfactory rating
	Major Exam	40	60		
CO 8: Apply parametric and integer programming whenever appropriate	Quizzes/Assignments/Others	60			90% of the class obtained a satisfactory rating
	Major Exam	40	60		
CO 9: Develop a report that describes the formulation of a model, its solution, and analysis, with recommendations in language understandable to decision makers	Quizzes/Assignments/Others	60			90% of the class obtained a satisfactory rating
	Major Exam	40	60		

Grading System

Midterm Grade
Quizzes---------------------- ----------------------------40%
Assignments/Others--------------------------------30%
Midterm Exam----------------------------------- 30%

Final Term Grade
Quizzes/Summative Exams------------------------40%
Assignments/Others--------------------------------30%
Final Exam--- 30%

Final Grade
 50% Midterm Grade+50% Final Term Grade

Passing Grade
50%

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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 emails. Submissions made outside will not be accepted.

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