



UNIVERSITY OF SOUTHERN MINDANAO					
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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	<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">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; and8. Comply with customer, regulatory and statutory requirements.
Goals of the College	<ol style="list-style-type: none">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	<p>The Department of Mathematics and Statistics aims to:</p> <ol style="list-style-type: none">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; and4. develop students' skills in creating and evaluating mathematical conjectures and arguments, and in validating their own mathematical thinking.



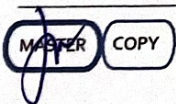
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PROGRAM INFORMATION					
Degree Program	Bachelor of Science in Applied Mathematics	CHED CMO Reference	48 series of 2017	BOR Approval	BOR Res. No. 24, s 2020

COURSE DETAILS					
Course Title	Numerical Analysis				
Course Number	Math 321	Curriculum Component	Major subject		
Credit (--Unit)	3 Units	LECTURE (Unit-Hours)	3 Units - 3 Hours	LABORATORY (Unit-Hours)	0 Units - 0 Hours
Prerequisites	Calculus III and Advanced Calculus	Co-requisites	Calculus I and II	Year Level/Semester Offered	3 rd Year - Second Semester
Course Description	This is an introduction to Numerical Analysis that deals with reviews of continuous and differentiable functions, IVT,				
Faculty in charge					
Consultation Hours			Contact Information		

PROGRAM EDUCATIONAL OBJECTIVES (PEO)				MISSION		
In 3-5 years, the BS Applied Mathematics 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)	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		✓									
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.



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COURSE OUTCOMES (CO)

Upon passing this course, the students must be able to:

Course Alignment to Program Outcomes

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	Define numerical analysis,see its applications and identify some mathematical software used for computing.																										
CO 2	Familiarize and apply important concepts in computer arithmetic and errors analysis																										
CO 3	Determine and apply some techniques of finding roots of a polynomial																										
CO 4	Introduce and apply some techniques of polynomial interpolation																										

* Level /follow the level of difficulty of the outcome

* 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).

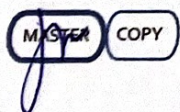
COURSE LEARNING PLAN

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 University 1.2 Explain the goals and objectives of the college. 1.3 Explain the Program Educational Objectives, Students Outcomes, and Course Outcomes.		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 numerical analysis 2.2 See the applications of numerical analysis to other fields of mathematics, physics and engineering	CO1	1	Introduction • Definition of Numerical Analysis • Numerical Analysis (theory, applied and implementation) • Algorithm • Good algorithms • Floating point arithmetic	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book(PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 1-17 [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 and Learning Activities (TLA) Teaching Activities Learning Activities	Learning Materials	Assessment Tasks (AT)	Suggested Readings	
			<ul style="list-style-type: none"> Mathematical software for numerical computing 					
3.1 Mastery of important concepts in computer arithmetic 3.2 Know how to compute using nested multiplication 3.3 Apply Horner's Algorithm of Synthetic Division	CO1	2-3	Computer Arithmetic <ul style="list-style-type: none"> Representation of numbers in computers Sorting numbers with fractional parts Fixed points representations Floating point representations Significant digits or precision Accuracy and precision Rounding and chopping Nested multiplication Horner's Algorithm or Synthetic Division 	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 18-34 [6]
4.1 Define numerical error 4.2 Determine possible sources of error 4.3 Differentiate and know how to compute absolute and relative errors	CO2	4	Error Analysis <ul style="list-style-type: none"> Definition of numerical error Sources of Error in Numerical Computations (Blunders) gross, Truncation, round-off, discretization, modelling, empirical constant, data uncertainty, input errors,) Absolute and Relative errors 	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 65-92 [6]pp. 18-32
5.1 Review Taylor Series 5.2 Recall Taylor's Theorem and mean-	CO2	5-6	Review of Taylor Series <ul style="list-style-type: none"> Taylor Series Complete Horner's Algorithm Taylor's theorem in Terms of (x- 	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 93-104 [6]pp. 18-32





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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
value Theorem			c) • Mean-Value Theorem • Taylor's Theorem in terms of		Task	Instructional Module	
5.3 Introduced to finding roots of a polynomial 5.4 Compare the analytical and numerical methods of finding roots of a polynomial	CO3	7	Introduction to Root Finding • Introduction • Root finding Problem • Analytical vs. Numerical Methods • Fundamental Theorem of Algebra	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises [2][3][4][5]pp. 105-110 [6]
6.1 Define and explain Bisection Method 6.2 Explain the Algorithm 6.3 See some computer simulations	CO3	7-8	Root Finding Method I • Bisection method • Intermediate Value Theorem • Algorithm • Stopping Criteria • Solved Examples • Computer simulations	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises [2][3][4] [5]pp.111-113 [6]
All ILOs covered in Midterm		9	Midterm Examination				
8.1 Define and explain Fixed point iteration method 8.2 Explain the Algorithm 8.3 See some computer simulations	CO3	10-11	Root Finding Method II • Fixed-point Iteration • Convergence of the Fixed Point Iteration • Fixed-point Iteration Theorem • Mean Value Theorem • Solved Examples • Computer simulations	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Powell p.113-116 [2][3][4][5]pp. 113-116 [6]
9.1 Define and explain Newton method 9.2 Explain the Algorithm 9.3 See some computer simulations	CO3	12-13	Root Finding Method III • The Newton Method • Algorithm for Newton Method • Newton's iterations	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC	Assignments Quizzes Exams Reflective paper USM VLE Exercises [2][3][4][5]pp. 117-131 [6]



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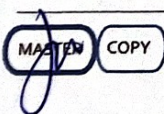
COURSE LEARNING PLAN

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
			<ul style="list-style-type: none"> Some familiar Computations using Newton's Method (Square root, nth root) A geometric interpretation of the Newton Method Solved examples Computer simulations 		Task	Instructional Module	
10.1 Define and explain Secant method 10.2 Explain the Algorithm 10.3 See some computer simulations	CO3	14-15	Root Finding Method IV <ul style="list-style-type: none"> The Secant Method Algorithm for Secant Method A geometric interpretation of the Newton Method Solved examples Computer simulations 	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises [2][3][4][5]pp. 117-131 [6]
11.1 Define interpolation 11.2 Compute and find the roots of a polynomial using different techniques	CO4	16-17	Polynomial Interpolation <ul style="list-style-type: none"> Linear Quadratic Higher-degree Newton's divided difference Basic Properties of divided differences Error in Polynomial Interpolation Interpolation using Splines 	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises [2]pp. 71-73 [3][4][5]pp. 117-131 [6]
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 Handbook
 [2] Azadi, F (2022) Applied Numerical Analysis with MATLAB/Simulink for Engineers and Scientists. <https://doi.org/10.1007/978-3-031-19366-8>





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- [3] Cheney, W. and D. Kincaid (2008) NUmberical Mathematics and Computing, 6th Edition. Thomson Brooks/Cole
- [4] Epperson, J. (2013). An introduction to numerical methods and analysis, 2nd Edition. Wiley and Sons, USA ISBN 978-1-118-36759-9.
- [5] Stoer, J. & R. Bulirsch (1993) Introduction to Numerical Analysis, 2nd Ed. Springer-Verlag.
- [6] Gautschi, W. (1997) Numerical Analysis, 2nd Ed. Springer, New York. DOI 10.1007/978-0-8176-8259-0.

Life-long Learning Opportunity

Apply some techniques in root finding and interpolation of a polynomial; familiarize some algorithms and, if possible, create a specific programs for it.

Course Evaluation

Course Outcomes (CO)	Assessment Task Addressing CO	Weight (%)	Satisfactory Rating	Target Standard
CO1: Define numerical analysis, see its applications and identify some mathematical software used for computing.	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		
CO2: Familiarize and apply important concepts in computer arithmetic and errors analysis	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		
CO3: Determine and apply some techniques of finding roots of a polynomial	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		
CO4: Introduce and apply some techniques of polynomial interpolation	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		

Grading System



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Midterm Grade

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

Final Grade

50% Midterm Grade+50% Final Term Grade

Final Term Grade

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

Passing Grade

50%

Classroom Policies

1. 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.
9. All submissions must be in USM VLE. Submissions made outside VLE will not be accepted.