



UNIVERSITY OF SOUTHERN MINDANAO
Course Syllabus for TIME SERIES ANALYSIS



Course Number

Math 324

Rev. No.

0

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EFFECTIVE DATE	REV. NO.	REVISION TYPE	CHANGE DESCRIPTION	PAGE AFFECTED	ORIGINATOR
January 16, 2023	0	New	Newly established syllabus for BS Applied Mathematics program for use. Flexible mode of instructions is adapted. Suggested readings with corresponding pages, URL and supplemental materials are included.	All	Daryl Mae Mamon

ELECTRONICALLY RELEASED

2025-07-09

Author:	Reviewer:	Verifier:	Validator:	Final Approver:	DCC USE ONLY
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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 activities 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.



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INSTITUTIONAL POLICIES

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	408 Series 2017	BOR Approval	BOR Res. No. 24, s 2020
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COURSE DETAILS

Course Title	Time Series Analysis				
Course Number	MATH 324	Curriculum Component		Major Course	
Credit (--Unit)	3	LECTURE (Unit-Hours)	3-3	LABORATORY (Unit-Hours)	0-0
Prerequisites	None	Coequisites	None	Year Level/Semester Offered	3 rd Year / Second Semester
Course Description	This course is an introduction to time series analysis. It covers describing the trends, seasonal fluctuations and irregular cycles in a set of time series data. Also, classical Exponential Smoothing Procedures and ARIMA model building will be discussed.				
Faculty in charge					
Consultation Hours			Contact Information		



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PROGRAM EDUCATIONAL OBJECTIVES (PEO)

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

		MISSION		
		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)

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 multicultural 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.	✓		✓								



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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	POw	POx	POy	POz
Upon passing this course, the students must be able to:		Course Alignment to Program Outcomes																									
CO 1	Demonstrate knowledge of the time series data.						I																				
CO 2	Employ the different procedures in model building for forecasting						I	I		I							I	I			I						
CO 3	Apply the classical time series analysis and seasonal adjustment						I	I		I		I				I		I	I		I						
CO 4	Investigate the models for stationary time series data						I	I		I								I	I		I						
CO 5	Inspect the models for nonlinear time series data						I	I		I		I				I		I	I		I						
CO 6	Develop the best time series model						I	I		I		I					I	I	I		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)	Aligned	Time	Course Content	Teaching & Learning Activities (TLA)	Learning	Assessment	Suggested
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				Teaching Activities	Learning Activities		
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 <ul style="list-style-type: none"> • Discussion on PEO, SO and CO 	Orientation Lecture/Discussion	Reading; Assignment	Computer; Chalkboard	Recitation [1] page 26, 32-33
2.1 Differentiate time series data from cross section data 2.2 Discuss the different components of time series model 2.3 Discuss the necessity of model building for forecasting	CO1 CO2	1-3	I. Introduction to Statistical Modeling of Time Series <ul style="list-style-type: none"> • Time Series versus Cross Section Data • Components of Time Series Models • Model Building Procedure for Forecasting • Measuring Forecasting Performance MSE, RMSE, MPE, MAPE 	Lecture/ Video Presentation/ Module	Reading Discussion Assignment Practice Activities VLE Tasks	Chalkboard Book PDF Workbook Laptop/PC	Quizzes Exams Practice Activities Reports/ Reflective paper [2] page 6-19, [3] page 27-42 [4] page 1-12
3.1 Demonstrate the use of plots in exploring time series data 3.2 Discuss the classical exponential smoothing procedures	CO1 CO3	4-6	II. Classical Time Series Analysis <ul style="list-style-type: none"> • Descriptive Analysis Using Charts/plots • Exponential Smoothing Procedures • Forecasting Using Exponential Smoothing Procedures 	Lecture/ Video Presentation/ Module	Reading Discussion Assignment Practice Activities VLE Tasks	Chalkboard Book PDF Workbook Laptop/PC	Quizzes Exams Practice Activities Reports/ SUMMATIVE EXAM 1 [3] page 183-215
4.1 Demonstrate seasonal adjustment in time series data	CO3	7	III. Seasonal Adjustment	Lecture/ Video Presentation/ Module	Reading Discussion Assignment Practice Activities VLE Tasks	Chalkboard Book PDF Workbook Laptop/PC	Quizzes Exams Practice Activities Reports/ [2] page 265-274



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COURSE LEARNING PLAN								
Intended Learning Outcomes (ILO) <i>By the end of the learning experience*, students must be able to:</i>	Aligned to CO:	Time Frame (Week)	Course Content (Topics)	Teaching & Learning Activities (TLA)		Learning Materials	Assessment Tasks (AT)	Suggested Readings
				Teaching Activities	Learning Activities			
5.1 Discuss the concepts of ARIMA modelling. 5.2 Understand some features of time series data using ARIMA modelling.	CO1	8	IV. Introduction to ARIMA <ul style="list-style-type: none"> Concepts used in ARIMA Modelling: acf, pacf, stationarity Identifying stationarity, seasonality, change in behavior using plots and sample acf/pacf 	Lecture/ Video Presentation/ Module	Discussion Assignment Practice Activities VLE Tasks	Chalkboard Book PDF Workbook Laptop/PC	Quizzes Exams Practice Activities Reports/ SUMMATIVE EXAM 2	[2] page 24-43 [4] page 23-30
All ILOs covered in Midterm								
6.1 Demonstrate test for stationarity in ARIMA modelling 6.2 Discuss the different steps of ARIMA model building.	CO2 CO4 CO5	9 10-12	V. ARIMA Modelling I <ul style="list-style-type: none"> A test for stationarity – ADF Test Differencing to Achieve Stationarity The Box-Jenkins Model Building Procedures 	Lecture/ Video Presentation/ Module	Discussion Assignment Practice Activities VLE Tasks	Chalkboard Book PDF Workbook Laptop/PC	Quizzes Exams Practice Activities Reports/ Reflective paper	[2] page 119-142 [3] page 221-229 [4] page 31-33; 46-50
7.1 Classify the different ARIMA models 7.2 Differentiate nonseasonal and seasonal ARIMA models	CO4 CO5	13-15	VI. ARIMA Modelling II <ul style="list-style-type: none"> Identification of ARIMA Models The ARIMA Models: Nonseasonal The ARIMA Models: Seasonal 	Lecture/ Video Presentation/ Module	Discussion Assignment Practice Activities VLE Tasks	Chalkboard Book PDF Workbook Laptop/PC	Quizzes Exams Practice Activities Reports/ SUMMATIVE EXAM 3	[2] page 275-282 [3] page 234-240, 252-261
8.1 Discuss the best model in a time series data. 8.2 Forecast using the best models for time series data.	CO2 CO6	16-17	VII. Forecasting and Diagnostics <ul style="list-style-type: none"> Estimation of Parameters Diagnostic Checking 				Quizzes Exams Practice Activities Reports/	[2] page 192-196, 224-230, 240-258 [3] page 275-283 [4] page 121-130



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COURSE LEARNING OUTCOMES

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
			• Forecasting				SUMMATIVE EXAM 4	
All ILOs covered in the Course		18						

FINAL EXAMINATION

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

Textbook/References

- [1] USM Student Manual
 [2] Pankratz, A. 1983. *Forecasting with Univariate Box-Jenkins Models: Concepts and Cases*. John Wiley & Sons.: Canada.
 [3] Hyndman, R. and Athanasopoulos, G. 2018. *Forecasting: Principles and Practice*. Contexts.
 [4] Mills, T. 2019. *Applied Time Series Analysis: A Practical Guide to Modeling and Forecasting*. Elsevier Inc.: United Kingdom

Life-long Learning Opportunity

Research

Course Evaluation

Course Outcomes (CO)	Assessment Task Addressing CO	Weight (%)	Satisfactory Rating	Target Standard
CO 1: Demonstrate knowledge of the time series data	Quizzes/Summative Exams	60	60	90% of the class obtained a satisfactory rating
	Midterm Exam	40		
	Final Exam			
CO 2: Employ the different procedures in model building for forecasting	Quizzes/Summative Exams	60	60	90% of the class obtained a satisfactory rating
	Midterm Exam	40		
	Final Exam			
CO 3: Apply the classical time series analysis and seasonal adjustment	Quizzes/Summative Exams	60	60	90% of the class obtained a satisfactory rating
	Midterm Exam	40		
	Final Exam			
CO 4: Investigate the models for stationary time series data	Quizzes/Summative Exams	60	60	90% of the class obtained a satisfactory rating
	Midterm Exam			
	Final Exam	40		
CO 5: Inspect the models for nonlinear time series data	Quizzes/Summative Exams	60	60	90% of the class obtained a satisfactory rating
	Midterm Exam			



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Course Evaluation

Course Outcomes (CO)	Assessment Task Addressing CO	Weight (%)	Satisfactory Rating	Target Standard
CO 6: Develop the best time series model	Final Exam	40	60	90% of the class obtained a satisfactory rating
	Quizzes/Summative Exams	60		
	Midterm Exam			
	Final Exam	40		

Grading System

Midterm Grade

Quizzes/Summative Exams-----	30%
Assignments/Seat works/Group Reports-----	30%
Midterm Exam-----	40%

Final Grade

50% Midterm Grade + 50% Final Term Grade

Final Term Grade

Quizzes/Summative Exams-----	30%
Assignments/Seat works/Group Reports-----	30%
Final Exam-----	40%

Passing Grade

50.0

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

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