هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title:	**Time Series Analysis**
Course Code:	**STA 1322**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**2 October 2024**

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A. General information about the course:

1. Course Identification

1. Credit hours:					
4 (3 Lectures, 1 Lab, 1 Tutorial)					
2. Course type					
A.	☐University	☐College	☒ Program	☐Track	☐Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: Level 6 / Year 3					
Level 6 / Year 3					
4. Course General Description:					
In statistics, time series is a fundamental technique to study model building strategies. The course introduces the general concept of time series and their stochastic processes, regression methods, residual analysis, models for stationary time series, autoregressive processes, models for nonstationary time series, ARIMA models, specifications of simulated time series, parameter estimations, moment, last square and maximum likelihood estimations.					
5. Pre-requirements for this course (if any):					
STA 1325					
6. Co-requisites for this course (if any):					
None					
7. Course Main Objective(s):					
▪ To provide students with a comprehensive understanding of the fundamental concepts of time series analysis, including components such as trend, seasonality, and cyclic patterns. ▪ To equip students with the skills to apply various time series models, including autoregressive integrated moving average (ARIMA) models, exponential smoothing, and seasonal decomposition. ▪ To develop proficiency in using statistical software (e.g., SPSS, R, Python) for analyzing time series data, performing model fitting, and generating forecasts. ▪ To foster critical thinking skills that enable students to evaluate the appropriateness of different time series models based on the characteristics of the data. ▪ To provide opportunities for students to apply time series analysis to real-world datasets, enhancing their problem-solving skills in various fields such as finance, economics, and environmental science.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	75	100%
2	**E-learning**	0	0%
3	**Hybrid** • Traditional classroom • E-learning	0	0%
4	**Distance learning**	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	15
3.	Field	0
4.	Tutorial	15
5.	Others (specify)	0
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	To define the concept of time series and its decomposition in trend part and stochastic part.	K1, K2	Lectures, Problem solving Classroom discussions	Direct: Regular Exams, Lab Assignments, Practical exam
1.2	To outline stationary and nonstationary time series and the ARIMA model.	K1, K3	Lectures, Problem solving Classroom discussions	Direct: Regular Exams, Lab Assignments, Practical exam
2.0	Skills			
2.1	To explain and interpret MA, AR, ARMA, ARIMA, and RW models.	S1, S2, S5	Lab lectures using statistical software, Interactive learning.	Direct: Lab Exam, Assignments, Practical exam
2.2	To apply statistical methods to analyze time series data and fit appropriate models.	S1, S2	Lecturing, Lab lectures using statistical software, Interactive learning.	Direct: Lab Exam, Assignments, Practical exam
2.3	To evaluate critically the results of time series analyses and their implications.	S2, S3	Lecturing, Interactive learning.	Direct: Assignments, Practical exam
2.4	To communicate findings from time series analyses effectively in reports and presentations.	S4, S5	Lab lectures using statistical software, Interactive learning..	Direct: Lab Exam, Assignments, Mini-project Practical exam
2.5	To perform basic calculations and summaries of time series data.	S3, S5	Lab lectures using statistical software, Interactive learning.	Direct: Lab Exam, Assignments, Mini-project Practical exam
3.0	Values, autonomy, and responsibility			
3.1	To demonstrate ethical considerations in the analysis and reporting of time series data.	V1, V2	Interactive learning, Group interaction, Problem solving.	Direct: Mini-project, Assignments,

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.2	**To show responsibility for the accuracy and integrity of data used in time series analysis.**	**V3**	**Interactive learning, Group interaction,**	**Direct:** Group Mini-project, Assignments,

C. Course Content

No	List of Topics	Contact Hours
1	**Fundamental Concepts:** Examples of Time Series, A Model-Building Strategy, Time Series Plots in History, Time Series and Stochastic Processes, Means, Variances, and Covariances, Stationary.	**10**
2	**Trends:** Deterministic Versus Stochastic Trends, Estimation of a Constant Mean, Regression Methods, Reliability and Efficiency of Regression Estimates, Interpreting Regression Output, Residual Analysis.	**13**
3	**Models for Stationary Time Series:** General Linear Processes, Moving Average Processes, Autoregressive Processes, The Mixed Autoregressive Moving Average Model, Invertibility.	**13**
4	**Models for Nonstationary Time Series:** Stationarity Through Differencing, ARIMA Models, Constant Terms in ARIMA Models, Other Transformations.	**13**
5	**Model Specification:** Properties of the Sample Autocorrelation Function, The Partial and Extended Autocorrelation Functions, Specification of Some Simulated Time Series, Nonstationarity, Other Specification Methods, Specification of Some Actual Time Series.	**13**
6	**Parameter Estimation:** The Method of Moments, Least Squares Estimation, Maximum Likelihood and Unconditional Least Squares, Properties of the Estimates, Illustrations of Parameter Estimation, Bootstrapping ARIMA Models.	**13**
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homeworks, Quizzes, Mini-projects**	**During the term**	**10%**
2.	**First Midterm**	**Week 5-6**	**25%**
3.	**Second Midterm (Lab Exam)**	**Week 10-11**	**25%**
4.	**Final Exam**	**Week 16-17**	**40%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Required Textbooks	▪ ***Time Series Analysis with application in R***, Jonathan D. Cryer and Kung-Sik Chan, 2nd Edition, Springer 2008. ISBN: 978-0-387-75958-6

	▪ ***An Introduction to Time Series Analysis and Forecasting: With Applications of SAS® and SPSS, 1st Edition,*** Robert Yaffee, Monnie McGee, Academic Press, 1996. ISBN: 9780127678702.
Essential References Materials	**1-** ***Introduction to Time Series and Forecasting,*** Peter J. Brockwell, Richard A Davis, Springer, 2002. **2-** ***Time Series Analysis,*** James Douglas Hamilton, Princeton University Press, 1994. **3-** ***The Analysis of Time Series: An Introduction,*** Chris Chatfield, Publisher: Chapman and Hall/CRC, 2003.
Electronic Materials	**Course Website: Learning Management Systems (Blackboard)**
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**The rooms should be equipped with data show and Smart Board.** **All computers should be equipped with the following software:** ▪ **Microsoft Excel** ▪ **IBM SPSS** ▪ **R-Project** ▪ **MATLAB**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Student and teaching staff**	**Surveys and Questionnaires**
Extent of achievement of course learning outcomes, Quality of learning resources	**Course Coordinator**	**Peer Reviews**
Quality of learning resources	**Students and teaching staff**	**Classroom Observations**
Other	**None**	

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	(08/10/2024) 05/04/1446