Form: Course Syllabus	**Form Number**	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	12/11/2024
	Number of Pages	07

1.	**Course Title**	**Time Series**
2.	**Course Number**	0331432
3.	**Credit Hours (Theory, Practical)**	3
	Contact Hours (Theory, Practical)	3
4.	**Prerequisites/ Corequisites**	0301333
5.	**Program Title**	B.Sc. Mathematics
6.	**Program Code**	
7.	**School/ Center**	Science
8.	**Department**	Mathematics
9.	**Course Level**	Elective Specialization Requirements
10.	**Year of Study and Semester (s)**	3rd or 4th year, 1st and 2nd or summer semester
11.	**Other Department(s) Involved in Teaching the Course**	None
12.	**Main Learning Language**	English
13.	**Learning Types**	■ Face to face learning ☐Blended ☐Fully online
14.	**Online Platforms(s)**	■ Moodle ■ Microsoft Teams
15.	**Issuing Date**	12/11/2024
16.	**Revision Date**	

17. Course Coordinator:

Name: Dr. Maalee Almheidat Contact hours:

Office number: Math. Dpt. 328 Phone number:

Email: m.almheidat@ju.edu.jo

18. Other Instructors:

Name:
Office number:
Phone number:
Email:
Contact hours:
Name:
Office number:
Phone number:
Email:
Contact hours:

19. Course Description:

As stated in the approved study plan. Descriptive techniques; types of variations: trend, cycle and seasonal fluctuations, autocorrelation; probability models for time series; stationary processes; autocorrelation function; estimation in time domain; fitting an autoregressive process; fitting a moving average process; forecasting; box and Jenkin`s methods; stationary processes in the frequency domain; spectral analysis.

20. Program Student Outcomes (SO's):

(To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. Identify, formulate, and solve broadly-defined technical or scientific problems by applying knowledge of Mathematics and Science and/or technical topics to areas relevant to the discipline.
2. Formulate or design a system, process, procedure or program to meet desired needs.
3. Develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
8. Utilize techniques, skills, and modern scientific tools such as mathematical packages, statistical software, graphing calculators, and online resources necessary for professional practice.

21. Course Intended Learning Outcomes (CLO's):

(Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. Understand Time Series Foundations including the definition of some concepts such as stationarity, autocorrelation, and stochastic processes, and explain their importance in time series analysis.
2. Analyze and Summarize Time Series Data by exploring the time series data using graphical tools, compute and interpret autocorrelation and partial autocorrelation functions, and describe the

properties of AR and MA processes.

3. Model Stationary Processes by formulate AR, MA, and ARMA models, analyze their covariance structure, and evaluate stationarity and invertibility conditions.
4. Forecast Time Series by Appling ARMA models to forecast time series and assess the accuracy of predictions using appropriate metrics.
5. Explore Frequency Domain Representations and analyze stationary time series using spectral analysis, understanding the connection between time and frequency domains.
6. Apply Theory to Practical Problems using statistical software to model, forecast, and interpret time series data from real-world applications, linking theory with practice.

Course CLOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
CLO (1)	•	•	•		•	
CLO (2)		•	•	•	•	
CLO (3)	•	•	•	•		
CLO (4)	•	•	•		•	
CLO (5)	•	•		•	•	
CLO (6)	•	•	•	•	•	•

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program SO's / Course CLO's	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)	SO (6)	SO (7)	SO (8)
CLO (1)	•							
CLO (2)	•	•	•					•
CLO (3)	•	•	•					•
CLO (4)	•	•	•					•
CLO (5)	•	•	•					•
CLO (6)	•	•	•					•

23. Topic Outline and Schedule:

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous Lecturing	Evaluation Methods	Learning Resources
1	1.1	Welcoming students. Discussing the Syllabus. Review of the main ideas of the prerequisite course.	1	F	Teams	S	Exam	Text Book
	1.2	**1. Introduction** 1.1. Examples of Time Series 1.2. Objectives of Time Series Analysis	1	F	Teams	S	Exam	Text Book
2	2.1	1.3. Some Simple Time Series Models 1.4. Stationary Models and the Autocorrelation Function	1	F	Teams	S	Exam	Text Book
	2.2	1.5. Estimation and Elimination of Trend and Seasonal Components	1	F	Teams	S	Exam	Text Book
3	3.1	1.6. Testing the Estimated Noise Sequence Problems	1	F	Teams	S	Exam	Text Book
	3.2	**2. Stationary Processes** 2.2. Linear Processes 2.3. Introduction to ARMA Processes	2	F	Teams	S	Exam	Text Book
4	4.1	2.4. Properties of the Sample Mean and Autocorrelation Function	2	F	Teams	S	Exam	Text Book
	4.2	2.4. Properties of the Sample Mean and Autocorrelation Function	2	F	Teams	S	Exam	Text Book
5	5.1	2.5. Forecasting Stationary Time Series	2	F	Teams	S	Exam	Text Book
	5.2	2.5. Forecasting Stationary Time Series	2	F	Teams	S	Exam	Text Book
6	6.1	2.6. The World Decomposition Problems	2	F	Teams	S	Exam	Text Book
	6.2	**First Exam**		F				
7	7.1	**3. ARMA Models** 3.1. ARMA(p, q) Processes	2, 3, 6	F	Teams	S	Exam	Text Book

	7.2	3.2. The ACF and PACF of an ARMA(p, q) Process	2, 3, 6	F	Teams	S	Exam	Text Book
8	8.1	3.2. The ACF and PACF of an ARMA(p, q) Process	2, 3, 6	F	Teams	S	Exam	Text Book
	8.2	3.3. Forecasting ARMA Processes	2, 3, 6	F	Teams	S	Exam	Text Book
9	9.1	3.3. Forecasting ARMA Processes	2, 3, 6	F	Teams	S	Exam	Text Book
	9.2	**4. Spectral Analysis** 4.1. Spectral Densities	3, 6	F	Teams	S	Exam	Text Book
10	10.1	4.2. The Periodogram	3, 6	F	Teams	S	Exam	Text Book
	10.2	4.3. Time-Invariant Linear Filters	3, 6	F	Teams	S	Exam	Text Book
11	11.1	4.4. The Spectral Density of an ARMA Process	3, 6	F	Teams	S	Exam	Text Book
	11.2	**Second Exam**		F				
12	12.1	**5. Modeling and Forecasting with ARMA Processes** 5.1. Preliminary Estimation	4, 6	F	Teams	S	Exam	Text Book
	12.2	5.2. Maximum Likelihood Estimation	4, 6	F	Teams	S	Exam	Text Book
13	13.1	5.3. Diagnostic Checking	4, 6	F	Teams	S	Exam	Text Book
	13.2	5.4. Forecasting	4, 6	F	Teams	S	Exam	Text Book
14	14.1	**6. Nonstationary and Seasonal Time Series Models** 6.1. ARIMA Models for Nonstationary Time Series	5, 6	F	Teams	S	Exam	Text Book
	14.2	6.2. Identification Techniques	5, 6	F	Teams	S	Exam	Text Book
15	15.1	6.3. Unit Roots in Time Series Models	5, 6	F	Teams	S	Exam	Text Book
	15.2	6.4. Forecasting ARIMA Models 6.5. Seasonal ARIMA Models	5, 6	F	Teams	S	Exam	Text Book

24. Evaluation Methods:

Opportunities to demonstrate achievement of the CLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	CLO/s Linked to the Evaluation activity	Period (Week)	Platform
First Exam	20%		1, 2	6-8	On Campus
Second Exam	30%		2, 3, 6	11	On Campus
Final Exam	50%		all	Final Exam period	On Campus

25. Course Requirements:

Each student must have:

- Mathematica software
- Account on Microsoft Teams
- Access to E-learning

26. Course Policies:

General Course Policies:

Attendance Policy: Attendance is expected. Arrival on time is expected. Students who miss more than three class sessions with or without excuse will be dismissed from the course automatically. (See the university policies regarding absence).

Cell Phone Policy: Cell phones should be turned off during class time. Disruption of class by ringing cell phones and cell phone conversations is inconsiderate of fellow students and faculty.

Examination Policy: Students unable to take a scheduled exam are expected to inform the instructor within 3 days and make arrangements for a make-up one. Make ups will be given only to students who have notified the instructor and set up an alternate time. Any missed exam will result in a grade of zero for that particular examination type.

Academic Integrity: Work submitted to the course instructor is assumed to be an expression of original ideas by the student. All students in this course are expected to adhere to university standards of academic integrity. Appropriate citation of the intellectual property of other authors is expected. Cheating, plagiarism, and other forms of academic dishonesty will neither be accepted nor tolerated. This includes, but is not limited to, consulting with another person during an exam, turning in written work that was prepared by someone other than you, and making minor modifications to the work of someone else and turning it in as your own. Ignorance will not be permitted as an excuse. If you are not sure whether

something you plan to submit would be considered either cheating or plagiarism, it is your responsibility to ask for clarification.

Communications: Contact by an email is highly encouraged and preferred. Other than contacts by an email, contacts should take place during announced office hours and/or ONLY by appointment. Contact on phones, preferably office number, also is welcomed during working hours.

27. References:

A- Required book (s), assigned reading and audio-visuals: Time Series: Theory ad Methods; P. Brockwell and R. Davis, Springer-Verlag.

B- Recommended books, materials, and media:

1. The Analysis of Time Series: An Introduction, C. Chatfield, Chapman and Hall.
2. Forecasting and time series: an applied approach. B. Bowerman and R. O'Connell, 3rd edition, 1993, Duxbury Press.
3. Time series modelling and forecasting in business and economics P.E. Gaynor and R. C. Kirpatrick, 1994, McGraw Hill.
4. Time series models. Harvey, A.C., 2nd Edition, 1993, Harvester Wheatsheaf.

28. Additional information:

Name of the Instructor or the Course Coordinator: **Dr. Maalee Almheidat**	Signature: ……	Date: ……
Name of the Head of Quality Assurance Committee/ Department: **Dr. Manal Ghanem**	Signature: ……	Date: ……
Name of the Head of Department: **Prof. Baha Alzalg**	Signature: ……	Date: ……
Name of the Head of Quality Assurance Committee/ School of Science: **Prof. Emad A. Abuosba**	Signature: ……	Date: ……
Name of the Dean or the Director: **Prof. Mahmoud I. Jaghoub**	Signature: ……	Date: ……