The University of Jordan

Accreditation & Quality Assurance Center

COURSE Syllabus

Course Name: Time Series

1	Course title	**Time Series**
2	Course number	(0301432)
3	Credit hours (theory, practical)	3
	Contact hours (theory, practical)	3
4	Prerequisites/corequisites	(0301333)
5	Program title	B.Sc.
6	Program code	
7	Awarding institution	The University of Jordan
8	Faculty	Science
9	Department	Mathematics
10	Level of course	College requirement
11	Year of study and semester (s)	all Semesters
12	Final Qualification	B.Sc. in Mathematics
13	Other department (s) involved in teaching the course	None
14	Language of Instruction	English
15	Date of production/revision	1.11.2016

16. Course Coordinator:

Office numbers, office hours, phone numbers, and email addresses should be listed.

Dr. Hisham M. Hilow

17. Other instructors:

Office numbers, office hours, phone numbers, and email addresses should be listed.

18. 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.

19. Course aims and outcomes:

A- Aims:

1- acquaint students with classical modeling of time series.
2- familiarize students with various smoothing techniques.
3- acquaint students with stationary time series models with emphasis on stationary ARIMA models and their building procedure.
4- acquaint students with non-stationary ARIMA modeling.
5- use computer software extensively in time series modeling and analysis.

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to ...

Successful completion of the course should lead to the following outcomes:

A. Knowledge and Understanding Skills: Student is expected to

A1. demonstrate knowledge of the main properties of MA, AR, ARMA, ARIMA and SARIMA time series models.
A2. use least squares, maximum likelihood and other estimation methods to fit time series models to real data.
A3. select proper time series model(s) using measures AIC or BIC.
A4. fit trend and seasonality to the time series data, and fit time series models to model residuals.
A5. understand methods used to produce forecasts and their updates.
A6. understand and critically assess time series models fitted by computer packages.
A7. communicate meaningfully and productively with others on time series analysis issues.

B. Intellectual Analytical and Cognitive Skills: Student is expected to

B1. apply complex ideas to solve time series problems.

B2. work with abstract concepts of time series and in a context of generality.

B3. perform time series modeling and analysis with high levels of accuracy.

C. Subject- Specific Skills: Student is expected to

C1. identify the basic characteristics of a time series.
C2. decompose the time series into various components (fluctuations, seasonal variation, cyclical variation, trend).
C3. distinguish between the deterministic and the nondeterministic components of a time series.
C4. specify a group of dummy variables that represent the seasonal variation in a time series.
C5. formulate an appropriate model for each deterministic time series component (trend, seasonality, cycle,…).
C6. perform model diagnostic checks to validate the fitted model by performing diagnostic checks and assessing the significance of the model parameters.
C7. make forecasts and updated forecast and assess their quality.
C8. derive the properties (expectation, autocovariance, autocorrelation, and the Yule-Walker equations) of stochastic time series models and to relate these properties to the behavior of those derived for real time series data.
C9. generate descriptive output for a stochastic time series process (S-ACF, S-PACF, and time series plots).
C10. select an appropriate criterion for comparison of various tentative models (AIC, forecast quality, parameter significance).

D. Creativity/Transferable Key Skills/Evaluation: Student is expected to

D1. apply mathematical, statistical and graphical time series techniques in an appropriate manner.
D2. communicate time series issues and results effectively and clearly in written and oral formats.
D3. analyse and solve complex time series problems accurately.

20. Topic Outline and Schedule:

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
❑ **Classical Time Series Modeling:** Autocorrelated data. Stationary versus Non-stationary time series. Regression time series and trend fitting. Sample Autocorrelation and Partial autocorrelation. Components of time series. Residual analysis. Smoothing techniques.	1-3				
❑ **Stationary time series:** Stationarity (weak and strict). White noise process and Random Walk process. The Backshift and Differencing operators. WOLD decomposition. Autocorrelation function (ACF). Partial autocorrelation function (PACF). Unit Root test for stationarity.	4-7				
❑ **Stationary ARMA modelling:** ACF and PACF for Pure autoregressive (AR) model and for Pure moving-average (MA) model. ACF and PACF for Mixed ARMA model. ACF and PACF for Seasonal ARMA model. Model identification. Model Estimation. Model Diagnostic checking. Akaike model selection criterion. Forecasting and updating forecasts. Forecast error and optimal forecasts.	8-11				
❑ **ARIMA modelling:** Integrated ARIMA model. Transformation to stationarity. Seasonal differencing. Seasonal Model. Forecasting seasonal time series. Case Studies.	12 - 15				

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following <u>teaching and learning methods</u>:

In order to succeed in this course, each student needs to be an active participant in learning – both in class and out of class.
- The instructor will spend most of the class time on presenting the new material as well as on discussing homework problems.
- Group work in this class is encouraged.
- To actively participate in class, you need to prepare for each class by reading the textbook and doing all assigned problems before class. (Problems will be assigned each class period, then to be discussed in class the following period).
- Each student should be prepared to discuss his/her homework at each class meeting.
- Students are encouraged to work together and to ask questions and seek help from your instructor, both in and out of class.
- Students are also encouraged to use graphing calculators extensively and to use computer software supplements.

22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following <u>assessment methods and requirements</u>:

ILO/s	Learning Methods	Evaluation Methods	Related ILO/s to the program
	Lectures	Exam	

23. Course Policies:

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled times. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.
2. If a student is absent for more than 10% of the lectures without an excuse (of sickness or due to other insurmountable difficulty), then the student shall be barred from sitting for the final examination. Also he/she will get a failing grade in the course.
3. Medical certificates for excuses of exam absences should be introduced to the University Physician for authorization. These authorized certificates should then be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.
4. Test papers shall be returned to students after correction, where the student mark is considered final after a lapse of one week following their return to the students.
5. Cheating is prohibited, where University cheating regulations will be applied on any student who cheats in exams or in homework.

24. Required equipment:

Data Shows

25. 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.

26. Additional information:

Name of Course Coordinator: Dr. Hisham M. Hilow Signature: ------------------------ Date: 1/11/2016

Head of curriculum committee/Department: Dr. Hisham M. Hilow Signature: --------------------------

Head of Department: Dr. Baha Alzalg Signature: --------------------------------

Head of curriculum committee/Faculty: Dr. Amal Al-Aboudi Signature: --------------------------------

Dean: Dr. Sami Mahmood Signature: --------------------------------

Copy to:
Head of Department
Assistant Dean for Quality Assurance
Course File