**KING FAHD UNIVERSITY OF PETROLEUM & MINERALS**

**MATHEMATICS DEPARTMENT**

# STAT 460: Time Series - Term 252 (Academic Year 2025-2026)

**Instructor:** Mohammad Farah Saleh **E-mail:** mohfarah@kfupm.edu.sa.
**Course Code and Title:** STAT-460: **Time Series**
**Course Credit Hours:** 3-0-3

**Textbook:** Time Series Analysis with Applications in R by Jonathan D. Cryer • Kung-Sik Chan, 2nd Edition, Springer, 2008.
**Software Package**: R language and R studio.

**Course Objectives:**

1. Define and explain the concepts and components of stochastic time series processes, including random walks, stationarity and autocorrelation.
2. Describe specific time series models, including, exponential smoothing, autoregressive, and autoregressive conditionally heteroskedastic models.
3. Calculate and Interpret predicted values and confidence and prediction intervals

**Course Description:** Examples of simple time series. Stationary time series and autocorrelation. Autoregressive moving average processes. Modeling and forecasting with ARMA processes. Maximum likelihood and least squares estimator. Nonstationary time series.

**Prerequisite:** STAT 310

**Course Learning Outcomes:** Upon successful completion of the course, a student should be able to

1. Explain the concepts and components of stochastic time series processes
2. Describe specific time series models
3. Calculate predicted values, confidence and prediction intervals
4. Interpret predicted values and confidence and prediction intervals

## Grading Policy

| Activity | Weight |
|---|---|
| Homework and other class activities | 10% |
| Term project | 10% |
| Quizzes | 10% |
| Exam 1: (Ch:1-3) | 20% |
| Exam 2: (Ch:4-5, Ch6:6.1-6.2) | 20% |
| Final Exam (Comprehensive): TBA | 30% |

*You need to achieve at least 50% in order to pass the course

**Exam Questions:** The questions of the exams are similar to the examples and exercises in the textbook.

**Cheating in Exams:** Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of DN in the course along with reporting the incident to the higher university administration for further action. Cheating in exams includes (but is not restricted to):

- Looking at the papers of other students.
- Talking to other students.
- Using mobiles, smart watches or any other electronic devices.

**Other Exam Issues:**

- No student will be allowed to take the exam if he/she does not bring his/her KFUPM ID, or National/Iqama ID, or Driver's License with him/her to the exam hall.
- Students are not allowed to have their mobiles, smart watches, or any electronic device in the exam hall. A violation of this will be considered an attempt of cheating.
- A student must sit in the seat assigned to him/her. A violation of this will be considered an attempt of cheating.

**Missing an Exam:** In case a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), he/she must bring an official excuse from Students Affairs. Otherwise, he/she will get a score of zero in the missed exam.

- **Attendance:** Students are expected to attend all lecture and lab classes.
- If a student misses a class/lab, he/she is responsible for any announcement made in that class/lab.
- After warned **twice** by the instructor, a **DN** grade will be awarded to any student who accumulates
    - 12 unexcused absences in lecture and lab classes. (20%)
    - 20 excused and unexcused absences in lecture and lab classes. (33.3%)

**The Usage of Mobiles in Class:** Students are not allowed to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes must take permission from their instructor. Violations of these rules will result in a penalty decided by the instructor.

**Academic Integrity:** All KFUPM policies regarding ethics apply to this course. See the Undergraduate Bulletin in the Registrar's website.

Course Contents

| Week | Date | Sections | Topics |
|---|---|---|---|
| 1 | Jan. 12-16 | 1.1-1.2 & 2.1 | Fundamental Concepts-including: Exploratory Data Analysis, time Series Visualization, Handling Missing Data, index numbers, smoothing techniques. |
| 2 | Jan. 19-23 | 2.2-2.4 | Means, Variances, and covariances, Stationarity and Stationarity Tests (Augmented Dickey-Fuller (ADF), Kwiatkowski-Phillips-Schmidt-Shin (KPSS), Phillips-Perron test), Summary |
| 3 | Jan. 26-30 | 3.1-3.3 | Deterministic Versus Stochastic Trends, Estimation of a constant mean, |
| 4 | Feb. 02-06 | 3.3-3.6 | Regression Methods: Interpreting Regression Output, Residual Analysis |
| 5 | Feb.09-13 | 3.6-3.7 | Residual Analysis (Continued), Summary |
| 6 | Feb.16-20 | 4.1-4.2 | General Linear Processes, Moving Average processes |
| 7 | Feb. 23-27 | 4.3 | Autoregressive Processes |
| 8 | Mar.02-06 | 4.3-4.5 | Autoregressive Processes (Continued), The Mixed Autoregressive Moving Average Model. Invertibility |
| 9 | Mar. 09-13 | 5.1-5.2 | Stationarity Through Differencing, ARIMA Models |
| 10 | Mar. 16-20 | 6.1-6.2 | Properties of the sample Autocorrelation Function, The partial and Extended Autocorrelation Functions |
| 11 | Apr. 06- 10 | 6.3-6.6 | Specification of Simulated Time Series, Nonstarionarity, Other specification Methods, specification of Some actual Time Series. |
| 12 | Apr.13-17 | 7.1-7.3 | The method of Moments, Least Squares Estimation, Maximum Likelihood and Unconditional Least Squares |
| 13 | Apr. 20-24 | 7.4-7.5 | Properties of the Estimates, Illustrations of Parameter Estimation. |
| 14 | Apr.27- May 01 | 8.1, 9.1-9.2 | Residual Analysis, Minimum Mean Square Error Forecasting, Deterministic Trends |
| 15 | May. 04-08 | 9.3, 10.1-10.5 | ARIMA Forecasting, Seasonal Models, Forecasting Seasonal Models. (If Time permits) |
| 16 | May 11 | | Forecasting Seasonal Models. (If Time permits) |