KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS

STAT 523 - Forecasting (Term 252 Syllabus)

Instructor: Dr. Mohammad H. Omar **Office:** Bldg. 5-508.
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Office Hours: UT: (5.30-6.30pm) or by appointment on MS Teams

Course Description: Time Series Basics; Autocorrelation; Modeling and forecasting with MA, AR, ARMA, ARIMA models; Seasonal and non-seasonal models; Model validation; Parameter selection; Smoothing and decomposition methods; Advanced forecasting methods, Multivariate models, State Space Models, ARCH and GARCH Models; projects using various software, toolboxes, and libraries like *R*, *Scikit-Learn*, and *Statsmodels*.

Prerequisite: STAT 503

Course Learning Outcomes

- Explain stationary and nonstationary models
- Describe some specific time series models such as multivariate models, State Space Models, ARCH and GARCH Models
- Use statistical packages to model and forecast real data sets.
- Forecast using time series models

Texts: ***Main*** **1)** Cryer, J. D. and Chan, K. (2009). Time Series Analysis with Applications in *R*, 2nd Ed, Springer, New York, USA.
2) Diebold, F. X. (2007). Elements of Forecasting. 4th Edition, Thomson, South-Western, Mason OH, USA.

References: handouts

Software: Main: *R* statistical language. Students are required to download *R* onto their laptop computers for assignments and practice. Instructions for downloading this free software is available on oneNote.

Also: Python's *Statsmodels* and *SciKit-Learn*.

Assessment

Activity	Weight
Classwork (Attendance and Participation, Assignments, Quizzes, etc)	15%
Term Paper Project (Group of 3 – declare by 3rd week) **Due Tuesday (Apr 14 week 12)**	20%
MidTerm Exam (topics 1 through 3) **Tuesday (Mar 3 week 8), 8.55pm – 10.55pm**	30%
Final Exam (Comprehensive) **As announced by Registrar**	35%

Excuse: There will be no make-up for the quizzes, homework, exams, and the final for students who miss any of them except for those who have an extreme case (they need to provide an official excuse with "exam included" checked and issued by Deanship of Student Affairs)

Academic Integrity: All KFUPM policies regarding ethics and academic honesty apply to this course. KFUPM dress codes must also be observed whenever on campus.

Cheating and Plagiarism: KFUPM follows "zero tolerance" approach with regard to cheating and plagiarism. During examinations (quizzes, exams, lab tests) cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of *F* in the course along with reporting the incident to the higher university administration.

Attendance: Students are **expected** to **attend all class meetings on-time.**

- Attendance on time is very important. **More than 10 minutes late = Absence** (regardless of any excuse).
- Mostly, attendance is checked within the ***first five minutes*** of the class. Entering the class after that, is considered as late (**2 lates= 1 Absence**)
- Do not leave before end of class. Attendance is marked as "present" only if you are in class for 80% of the duration of the class.
- If a student misses a class, he/she is responsible for any announcement made in that class.

- According to University rules, after warned **twice** by the instructor, a DN grade will be awarded to any student who excessively accumulates
  - 6 unexcused **absences** in lectures. (20%)
  - 10 **total absences** (excused and unexcused) in lectures. (33.3%)
- Only official excuse from KFUPM student affairs office will be accepted. All other excuses (medical centers, governmental offices, etc) are not.

Mobile phones: The use of mobiles is *strictly banned* during class. Students are required to keep their phones off/silent and placed inside their pockets during the class timings. Students who want to use electronic devices to take notes **must take permission** from their instructor.

Important Notes:

- ✓ Homework is due in class every Sunday a chapter is completely covered.
- ✓ A class quiz is often given at the end of the following week a topic is completely covered.
- ✓ A formula sheet (check OneNote) and statistical tables will be provided for you in every exam.

Student Responsibilities:

- You will be encouraged to participate in the class.
- Keep up with the material presented in class. If you get behind it, it will not be easy to recover.
- Submit assignments on time.
- Teamwork will be encouraged for Project-related activities

Weekly topical breakdown

week	start	end	topic	Diebold	CryerChan
1	11-Jan	13-Jan	1 Time Series Basics	Ch1: p.1-13	1.1 to 1.2
2	18-Jan	20-Jan	2 Autocorrelation		Ch 2
3	25-Jan	27-Jan	3 Modeling and forecasting with MA, AR, ARMA, ARIMA		Ch 4 & 5
			Term paper data and topic due		
4	1-Feb	3-Feb	(Continue) Forecasting with MA, AR, ARMA, ARIMA	Ch9	9.1,9.3-9.9
5	8-Feb	12-Feb	4.Seasonal and non-seasonal models;		Ch10
6	15-Feb	17-Feb	4. Seasonal and non-seasonal models; (Continue)		
7	24-Feb	24-Feb	5. Model validation		Ch 8+s3.6
			Mid-Term (Mar 3 8.55pm- 10.55pm)		
8	1-Mar	3-Mar	6. Parameter selection		Ch7&S6.3
9	8-Mar	10-Mar	6. Parameter selection (Continue)		
	15-Mar	26-Mar	**Eid Break**		
10	29-Mar	31-Mar	7. Smoothing and decomposition methods	Ch10	
11	5-Apr	7-Apr	8. Multivariate models	**Handout**	
			Term paper due (Tues Apr 14)		
12	12-Apr	14-Apr	9. ARCH and GARCH Models		Ch 12
13	19-Apr	21-Apr	ARCH and GARCH (Continue)	Ch 14	
14	26-Apr	28-Apr	10. State Space Models	**Handout**	
15	3-May	5-May	State Space Models (Continue)		
16	10-May		Review		

Some tips to enhance your problem-solving skills:

- ❖ Do all homework assignments on time.
- ❖ Practice (but not memorize) more problems than those given in the above list.
- ❖ Solve some review exercises available at the end of each chapter.
- ❖ Solve the problems on your own before reading the solution or asking for help.
- ❖ If you find it difficult to handle a certain type of problems, you should try more problems of the same type.
- ❖ Try to make good use of office hours of your instructor. Always bring your solution trials to discuss them with your instructor.

Homework

Hwk	questions		General Remark
1	CC Ch1: 1 and 4	Diebold Ch1: 1 and 4	Use package TSA
2	CC ch2: 5, 15, and 24		Use package TSA
3	CC ch4: 6, 14, and 19		Use package TSA
4	CC ch5: 2, 7 and 11		Use package TSA
5	CC ch9: 2, 12 and 22		Use package TSA
6	CC ch10: 2, 5, and 10		Use package TSA