Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): **STAT 3830 TIME SERIES AND FORECASTING (3,3,0)**

Course Aims: The course aims at providing students with an understanding of the statistical methods for time series data whose order of observation is crucially important in depicting the background dynamics of the related social, economical, and/or scientific phenomena. The students will learn to use various time series models and techniques such as exponential smoothing, ARIMA, etc., to model and make forecasts. Corresponding programming techniques to facilitate these practices will also be introduced within the platforms of MATLAB. Case studies will be provided to make the students acquainted with the elementary techniques.

Prerequisite: STAT 2110 Regression Analysis

Prepared by: H. Peng

Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to understand basic time series models and their characteristic.
2	Able to apply regression techniques to model time series data
3	Able to apply exponential smoothing methods to forecast time series
4	Able to apply exponential smoothing methods to forecast nonseasonal and seasonal time series
	Skills
5	Able to manipulate the software Matlab
6	Able to plot graph for time series
7	Able to write some basic program to model and forecast time series.
	Attitudes
8	Able to work effectively in a team
9	Able to solve problems independently

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment (assignments, and mini-project)	30%	Assignments are designed to measure students understanding of the theory of time series analysis and forecast. The mini-project is designed to achieve LO 5-9 by facilitating students working in a team environment to model and forecast time series data.
2	Final Examination	70%	Final Examination is designed to see how far students have achieved their intended learning outcomes especially in the Knowledge domain. Students should have a thorough understanding of the knowledge and apply them correctly in different context to do well in the exam.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Application of Regression Model in Forecasting	2, 3	4
II. Non-seasonal Series: Regression and Smoothing Methods	2-3, 5--7	8
III. Seasonal Series: Regression and Smoothing Methods	2,4--7	6
IV. Non-seasonal Stochastic Models	1, 2, 5--7	10
V. Seasonal ARIMA Model	1, 2, 5--7	8
VI. Case Study	2--7	4

Textbook: B. Abraham and J. Ledolter, Statistical Methods for Forecasting, Wiley, 1983.

References:

P.J. Brockwell and R.A. Davis, Introduction to Time Series and Forecasting, Springer, 1996.

G.E.P. Box, G.M. Jenkins and G.C. Reinsel, Time Series Analysis: Forecasting and Control, Prentice-Hall International, 1994.

J.D. Cryer, Time Series Analysis, Duxbury Press, 1986.

W.W.S. Wei, Time Series Analysis: Univariate and Multivariate Methods, Addison-Wesley, 1990.

Shumway, Robert H, Time series analysis and its applications, New York : Springer, 2000.

Yaffee, Robert A. Introduction to time series analysis and forecasting : with applications of SAS and SPSS, San Diego, Academic Press, 2000.

Chan, Ngai Hang, Time series : applications to finance, New York : Wiley-Interscience, 2002.

Software: Matlab

Course Content in Outline:

	Topic	Hours
I.	Application of Regression Model in Forecasting	4
	A. Review of regression analysis	
	B. Errors with serial correlation	
	C. Weighted least squares	
II.	Non-seasonal Series: Regression and Smoothing Methods	8
	A. Local constant mean model and simple smoothing	
	B. Discounted least squares and general exponential smoothing	
	C. Local trends and exponential smoothing	
	D. Predication intervals for future values	
III.	Seasonal Series: Regression and Smoothing Methods	6
	A. Modeling seasonality in constant mean model	
	B. Globally and locally constant seasonal models	
	C. Winter's constant seasonal models	
	D. Seasonal adjustment	
IV.	Non-seasonal Stochastic Models	10
	A. Stationary process and ARMA model	
	B. Non-stationary process and ARIMA model	
	C. Forecasting	
	D. Model specification	
	E. Parameter estimation	
	F. Model checking	
V.	Seasonal ARIMA Model	8
	A. Multiplicative seasonal models	
	B. Model building	
	C. Regression and seasonal ARIMA models	
	D. Seasonal adjustment using seasonal ARIMA models	
VI.	Case Studies	4