OFFICIAL UNDERGRADUATE COURSE OUTLINE (page 1)

UNIVERSITY OF THE FRASER VALLEY

COURSE IMPLEMENTATION DATE:	January 2006
COURSE REVISED IMPLEMENTATION DATE:	January 2012
COURSE TO BE REVIEWED:	November 2017
(six years after UEC approval)	*(month, year)*

OFFICIAL UNDERGRADUATE COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department – see course syllabus available from instructor

COURSE NAME/NUMBER	FACULTY/DEPARTMENT	UFV CREDITS
MATH 430	Science / Mathematics & Statistics	3

COURSE DESCRIPTIVE TITLE: Time Series and Forecasting

CALENDAR DESCRIPTION:

This course introduces the basic ideas of time series analysis and forecasting methods. Topics include stationarity, autocovariance, autocorrelation and partial autocorrelation functions, and the Box-Jenkins classical time series models such as MA(q), AR(p), ARMA(p,q), ARIMA(p,q), and SARIMA models. The emphasis of this course is on the practical implementation of the methods and the analysis of time series data. Students are expected to complete a group project, analyzing some real-life data.

Note: Students with credit for MATH 390 may not take MATH 430 for further credit.

PREREQUISITES: MATH 315 or MATH 271
COREQUISITES:
PRE or COREQUISITES:

SYNONYMOUS COURSE(S):
(a) Replaces: MATH 390
(b) Cross-listed with:
(c) Cannot take: for further credit.

SERVICE COURSE TO: *(department/program)*

TOTAL HOURS PER TERM: 45

STRUCTURE OF HOURS:

Lectures:	30	Hrs
Seminar:		Hrs
Laboratory:	15	Hrs
Field experience:		Hrs
Student directed learning:		Hrs
Other (specify):		Hrs

TRAINING DAY-BASED INSTRUCTION:
Length of course:
Hours per day:

OTHER:
Maximum enrolment: 36
Expected frequency of course offerings: Every two years
(every semester, annually, every other year, etc.)

WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☐ Yes	☐ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☐ Yes	☒ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☒ No

Course designer(s): **David Chu**

Department Head:	**Greg Schlitt**	Date approved:	**November 29, 2010**
Supporting area consultation (Pre-UEC)		Date of meeting:	**October 7, 2011**
Curriculum Committee chair:	**Norm Taylor**	Date approved:	**October 21, 2011**
Dean/Associate VP:	**Ora Steyn**	Date approved:	**November 4, 2011**
Undergraduate Education Committee (UEC) approval		Date of meeting:	**November 25, 2011**

LEARNING OUTCOMES:

Upon successful completion of this course, students will be able to:

1. show whether a time series is stationary or not;
2. calculate the autocovariance, autocorrelation and partial autocorrelation functions of an ARMA process;
3. determine the conditions for the causality and invertibility of an ARMA process;
4. forecast the future values or estimate a missing value of a given time series based on the criterion of minimum mean squared error;
5. establish the Yule-Walker equation and find the estimates of the parameters;
6. use computer software to fit an ARIMA model to a given time series using the AICC criterion, with diagnostic checking and tests for randomness of the residuals;
7. construct appropriate ARIMA models for non-stationary time series;
8. formulate and forecast seasonal ARIMA models;
9. complete a group project, analysing the time series data in a real-life problem.

METHODS: *(Guest lecturers, presentations, online instruction, field trips, etc.)*

Lectures and computer labs using appropriate computer software, e.g., ITSM 2000, MINITAB and spreadsheets.

METHODS OF OBTAINING PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

☒ Examination(s) ☐ Portfolio assessment ☐ Interview(s) ☒ Other (specify): Course Challenge

☐ PLAR cannot be awarded for this course for the following reason(s):

TEXTBOOKS, REFERENCES, MATERIALS: *[Textbook selection varies by instructor. Examples for this course might be:]*

Brockwell, P.J. and Davis, R.A. 2002. Introduction to Time Series and Forecasting. Second edition. Springer.
Box, G.E.P. and Jenkins, G.W. 2001. Time Series Analysis, Forecasting and Control. Third edition. Prentice-Hall.
Farnun, N.R. and Stanton, L.W. 1989. Quantitative Forecasting Methods. PWS-Kent Publishing.

SUPPLIES / MATERIALS:

STUDENT EVALUATION: *[An example of student evaluation for this course might be:]*

Assignments	20%
Test	20%
Project	20%
Final Exam	40%

The above percentages may vary among instructors and years. The final exam is comprehensive. Students must achieve at least 40% on the final exam in order to pass this course.

COURSE CONTENT: *[Course content varies by instructor. An example of course content might be:]*

First notions: methods of forecasting, differencing, regression, moving averages, Fourier methods, trend, seasonality, classical decomposition model.

Stationary processes: covariance, weakly stationary, strictly stationary, basic properties, white noise, moving-average MA(q) processes, auto-regressive AR(p) processes, linear processes, sample covariance matrix, Bartlett's formula.

ARMA models: auto-regressive moving-average ARMA(p,q) processes, calculations of the autocovariance function, autocorrelation function and partial autocorrelation function, causality, invertibility.

Minimum mean squared error forecasts: the best linear predictor, n-step prediction, prediction of second-order random variables, estimation of a missing value.

Modeling and foresting with ARMA processes: Yule-Walker estimation, Burg's algorithm, innovations algorithm, Hannan-Rissanen algorithm, maximum likelihood estimation, diagnostic checking, tests for randomness of the residuals, forecasting, order selection, FPE criterion, AICC criterion.

Non-stationary and seasonal time series models: auto-regressive integrated moving average ARIMA(p,d,q) models for non-stationary time series, identification techniques, Box-Cox transformation, unit roots in autoregressions, unit roots in moving averages, the forecast function, seasonal ARIMA models, regression with ARMA errors.

Holt-Winter's seasonal and ARIMA forecasting.