UNIVERSITY COLLEGE of the FRASER VALLEY

COURSE IMPLEMENTATION DATE: January 2006
COURSE REVISED IMPLEMENTATION DATE:
COURSE TO BE REVIEWED: September 2009
(Four years after UPAC Final Approval Date) (MONTH YEAR)

OFFICIAL 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 and the material will vary - see course syllabus available from instructor

FACULTY/DEPARTMENT: **Science, Health & Human Services / Mathematics & Statistics**

MATH 430		**3**
COURSE NAME/NUMBER	FORMER COURSE NUMBER	UCFV CREDITS

Time Series & Forecasting
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

This course provides an introduction to the basic ideas of time series analysis and to the Box-Jenkins auto-regressive integrated moving-average (ARIMA) family of models in particular. It covers both the theory and applications. Students are expected to complete a group project, analyzing some real-life data in time series.

Note: Students who have credit for Math 390 may not take Math 430 for further credit.

PREREQUISITES: **(Math 270 and one of Math 302 or Math 315) or Math 370.**
COREQUISITES:

SYNONYMOUS COURSE(S)
(a) Replaces: **Math 390** *(Course #)*
(b) Cannot take: **Math 390** *(Course #)* for further credit.

SERVICE COURSE TO:
(Department/Program)
(Department/Program)

TOTAL HOURS PER TERM: **60**
STRUCTURE OF HOURS:

Lectures:	**30**	Hrs
Seminar:		Hrs
Laboratory:	**30**	Hrs
Field Experience:		Hrs
Student Directed Learning:		Hrs
Other (Specify):		Hrs

TRAINING DAY-BASED INSTRUCTION
LENGTH OF COURSE:
HOURS PER DAY:

MAXIMUM ENROLLMENT: **36**
EXPECTED FREQUENCY OF COURSE OFFERINGS: **Every second year**

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

AUTHORIZATION SIGNATURES:

Course Designer(s): Math & Stats Department
Chairperson: Gillian Mimmack *(Curriculum Committee)*
Department Head: Gillian Mimmack
Dean: Jacalyn Snodgrass
PAC Approval in Principle Date:
PAC Final Approval Date: September 30, 2005

LEARNING OBJECTIVES / GOALS / OUTCOMES / LEARNING OUTCOMES:

Successful students will be able to:

1. show whether a time series is stationary or not;
2. calculate the autocovariance function, autocorrelation function and partial autocorrelation function 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. find the periodgram and spectral density function;
6. establish the Yule-Walker equation and find the estimates of the parameters;
7. 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;
8. construct appropriate ARIMA models for non-stationary time series;
9. complete a group project, analysing the time series data in a real-life problem.

METHODS:

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

PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

Credit can be awarded for this course through PLAR (Please check:) ☒ Yes ☐ No

METHODS OF OBTAINING PLAR:

Please check online at http://www.ucfv.ca/math/challenge.htm for the departmental challenge policy.

TEXTBOOKS, REFERENCES, MATERIALS:

[Textbook selection varies by instructor. An example of texts for this course might be:]

The text is chosen by a departmental curriculum committee.

Recommended texts are:

Brockwell, P.J. anmd 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 (biweekly)	20%
Mid-term Test	20%
Group Project	20%
Final Exam	40%

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, the autocorrelation function and the 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.

Spectral analysis: spectral densities, periodogram, time-invariant linear filters, the spectral density of an ARMA process.

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.