ORIGINAL COURSE IMPLEMENTATION DATE:	January 2006
REVISED COURSE IMPLEMENTATION DATE:	September 2020
COURSE TO BE REVIEWED (six years after UEC approval)**:**	November 2025

Course outline form version: 05/18/2018

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: STAT 430

Number of Credits: 3 Course credit policy (105)

Course Full Title: Time Series and Forecasting

Course Short Title:

(Transcripts only display 30 characters. Departments may recommend a short title if one is needed. If left blank, one will be assigned.)

Faculty: Faculty of Science

Department (or program if no department): Mathematics & Statistics

Calendar Description:

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 models. Focuses on the practical implementation of the methods and analysis of real-life time series data using statistical software.

Prerequisites (or NONE):	STAT 315 or STAT 271.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	

Antirequisite Courses *(Cannot be taken for additional credit.)*

Former course code/number: **MATH 390, MATH 430**

Cross-listed with:

Dual-listed with:

Equivalent course(s):

(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Special Topics *(Double-click on boxes to select.)*

This course is offered with different topics:

☒ No ☐ Yes *(If yes, topic will be recorded when offered.)*

Independent Study

If offered as an Independent Study course, this course may be repeated for further credit: *(If yes, topic will be recorded.)*

☒ No ☐ Yes, repeat(s) ☐ Yes, no limit

Typical Structure of Instructional Hours

Lecture/seminar hours	
Tutorials/workshops	
Supervised laboratory hours	50
Experiential (field experience, practicum, internship, etc.)	
Supervised online activities	
Other contact hours:	
Total hours	**50**

Labs to be scheduled independent of lecture hours: ☒ No ☐ Yes

Transfer Credit

Transfer credit already exists: *(See* ***bctransferguide.ca****.)*

☒ No ☐ Yes

Submit outline for (re)articulation:

☒ No ☐ Yes *(If yes, fill in transfer credit form.)*

Grading System

☒ Letter Grades ☐ Credit/No Credit

Maximum enrolment (for information only): 36

Expected Frequency of Course Offerings:

Every two years

Department / Program Head or Director: Ian Affleck	**Date approved:**	June 18 2019
Faculty Council approval	**Date approved:**	October 4, 2019
Dean/Associate VP:	**Date approved:**	October 4, 2019
Campus-Wide Consultation (CWC)	**Date of posting:**	November 8, 2019
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	November 22, 2019

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 situation.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

Lectures and computer labs using appropriate computer software, e.g., SAS Time Series Studio, MINITAB and spreadsheets.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials *(If more space is required, download Supplemental Texts and Resource Materials form.)*

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Brockwell, P.J. and Davis, R.A.	Introduction to Time Series and Forecasting. Third edition.	☐	Springer	2016
2.	Box, G.E.P. et al.	Time Series Analysis, Forecasting and Control. Fifth edition.	☐	Wiley	2015
3.			☐		

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Typical Evaluation Methods and Weighting

Final exam:	40%	Assignments:	20%	Field experience:	%	Portfolio:	%
Midterm exam:	20%	Project:	20%	Practicum:	%	Other:	%
Quizzes/tests:	%	Lab work:	%	Shop work:	%	Total:	100%

Details (if necessary):

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.

Typical Course Content and Topics

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.