ORIGINAL COURSE IMPLEMENTATION DATE: January 1994
REVISED COURSE IMPLEMENTATION DATE: January 2021
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 470	**Number of Credits:** 3 Course credit policy (105)

Course Full Title: Applied Multivariate Statistical Analysis
Course Short Title: Applied Multivariate Analysis
(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:

Focuses on a range of widely-used multivariate statistical techniques, their relationship with familiar univariate methods, and the solution to practical problems using statistical software. Topics include Hotelling's T^2, MANOVA, multivariate regression, principal components, factor analysis, and discrimination and classification analysis.

Prerequisites (or NONE):	One of the following: STAT 271, STAT 315, or STAT 330.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	

Antirequisite Courses *(Cannot be taken for additional credit.)*
Former course code/number: **MATH 470**
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.)

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

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

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. Use Hotelling's T^2 to test a plausible value of a multivariate normal population mean;
2. Construct confidence regions, simultaneous confidence statements, and Bonferroni intervals for a normal population mean;
3. Test the equality of two population mean vectors;
4. Test the equality of three or more population mean vectors;
5. Develop the notion and techniques used in multiple linear regression to multivariate multiple linear regression;
6. Perform principal component analysis to transform a number of possibly correlated variables into a number of uncorrelated variables;
7. Perform factor analysis to describe variability among observed variables in terms of a potentially lower number of unobserved variables;
8. Discriminate observations into two or more labeled classes and assign new observation to the labeled classes;
9. Use statistical software to analyze multivariate data.

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, class discussion, use of statistical software in computing labs.

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.)*

The textbook is chosen by a departmental curriculum committee. Recent text used:

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Johnson and Wichern	Applied Multivariate Statistical Analysis. Sixth edition.	☒	Pearson	2019
2.			☐		
3.			☐		
4.			☐		
5.			☐		

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:	%	Project:	10%	Practicum:	%	Other:	%
Quizzes/tests:	30%	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 obtain at least 40% on the final exam in order to receive credit for this course.

Typical Course Content and Topics

1. Introduction to multivariate data: graphical presentation, mean vector, variance covariance matrix, and correlation matrix.
2. Inference about a mean vector: Hotelling's T^2, confidence regions, simultaneous confidence statements, Bonferroni intervals.
3. Compare mean vectors from two normal populations: assumptions, test equality of two mean vectors, simultaneous confidence intervals.
4. Compare several population mean vectors (one-way MANOVA): assumptions, Wilks' lambda, test equality of three or more mean vectors.
5. Multivariate multiple linear regression: least squares estimation, inference for the parameters of the model, model diagnostics, checking the validity of the model.
6. Principal component analysis: Population principal components, summarizing sample variation using principal components analysis, large sample inference.
7. Factor analysis: the orthogonal factor model, factor estimation, factor rotation, factor scores, perspectives and strategy for factor analysis.
8. Discrimination and classification: separation and classification for two populations, Fisher's discrimination method, classification with several populations.