

Course Name:	MULTIVARIATE METHODS
Course Code:	STAT2004
Number of Credits:	3
Semester:	II
Level:	2
Pre-requisites:	STAT1001: Statistics for the Sciences, MATH1141: Introductory Linear Algebra and Analytic Geometry, MATH2410: A First Course in Linear Algebra

RATIONALE: Multivariate analysis is an important branch of statistics dealing with procedures for summarising, representing and analysing multiple quantitative measurements obtained on a number of individuals or objects. The procedures identify clearly patterns in data where such patterns exist. Many of the techniques are hypothesis generating rather than hypothesis testing. Many scientific disciplines make use of such techniques for investigating and better understanding large and complex datasets.

COURSE DESCRIPTION: During this course, commonly used multivariate techniques will be introduced and developed, and relationships between them examined. The emphasis of the course will be practical application and interpretation of results using a range of scientific related examples, such as: What are the attitudes of young teenagers to smoking? Factor analysis identifies these from survey and allows anti-smoking policies to be developed. How do you identify the origin of oysters, which caused food poisoning in a restaurant? Trace element readings answer this question using discriminant function analysis. How do you identify the growth of fresh water fish in and outside its natural habitat? Principal components answer this question.

The mathematical details are kept to a minimum. For practical work, students may choose to use the statistics package R, MINITAB or SPSS.

LEARNING OUTCOMES: On successful completion of the course, the students should be able to:

- State the difference between univariate and multivariate analysis
- Construct hypothesis testing involving multivariate data

- Analyse and interpret computer output of their choice
- Interpret and communicate the information obtained effectively
- Choose the most appropriate multivariate technique for their data
- Test the assumptions of a multivariate analysis
- Solve problems involving multivariate data

COURSE CONTENT

1. **Introduction:** areas of application, organisation of data, graphical techniques, geometry interpretation
2. **Matrix Algebra & Random Vectors:** Introduction, Review of matrix and vector algebra; Positive definite matrix; Random vectors and matrices; Mean vectors and Covariance matrices
3. **Multivariate Normal Distribution:** Introduction, Density and its properties, Maximum likelihood estimators of μ and Σ
4. **Inferences:** Sampling distribution of \bar{X} and S , Hotelling's T^2 , and Confidence regions
5. **Methods:** Principal Component Analysis, Discriminant Analysis, Factor Analysis, Canonical Correlation Analysis and Cluster Analysis

TEACHING METHODOLOGY: This course will be delivered by a combination of interactive lectures, problem based learning and computer laboratory. The **39** contact hours is consists of: **26 hours of lectures, 8 hours of problem based learning and 10 hours of supervised laboratory time**. Course materials such as problem papers, assignments, solutions, etc., will be posted on the webpage. <http://ourvle.mona.uwi.edu/>

ASSESSMENT: The course assessment is as follows:

- (i). Mid-term test (1 hour) worth **15%** of the student's final grade
- (ii). Problems papers and lab assignments (about 5), worth **15%**
- (iii). Final written examination paper worth **70%** will be two hours in length.

REFERENCE MATERIALS:

Books:

Prescribed

1. Johnson R., & Wichern D. 2007, *Applied Multivariate Statistical Analysis, 6th Edition*, Pearson, ISBN-13: 978-0131877153

Recommended

2. Mardia K.V., Kent J.T. & Bibby J.M., 1980, *Multivariate Analysis, 1st Edition*, Academic Press, ISBN-13: 978-0124712522
3. Johnson D. 1998, *Applied Multivariate Methods for Data Analysis, 1st Edition*, Pearson, ISBN-13: 978-0534237967

ONLINE RESOURCES

<http://www.causeweb.org/>

<http://www.getstats.org.uk/>

<http://www.ats.ucla.edu/stat/seminars/statteach/sites.htm>

<http://onlinestatbook.com/rvls.html>

