# BComHons Mathematical Statistics (07240244)

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|---|---|
| **Duration of study** | 1 year |
| **Total credits** | 135 |
| **Contact** | Prof IN Fabris-Rotelli   inger.fabris-rotelli@up.ac.za   +27 (0)124205420 |

## Admission requirements

- Relevant BCom degree with with an average of at least 65% in Mathematical Statistics or equivalent on 3rd year level.
- Student numbers are limited to a maximum of 40 collectively over all honours programmes in the Department of Statistics.
- Historical performance during prior studies will also be considered in selecting students. Specific attention will be given to modules repeated and duration of study.
- The progress of all honours candidates is monitored biannually by the postgraduate coordinator/head of department. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

1. Registration for a second field of study With reference to General Regulation G.6, a student who has already completed a bachelor of honours degree at this or another university, may, with the permission of the Dean, register for another degree, subject to the regulations applicable to the field of study in question and to any other stipulations the Dean may prescribe on the condition that there shall be no overlap in the course content of the first degree and the second degree. Such a concession may be withdrawn by the Dean/Deans if the student does not perform satisfactorily.

2. Acknowledgement of modules

2.1. Subject to the stipulations of G.22.1, G.23.2 and the Joint Statute, a Dean may acknowledge modules passed at another tertiary institution or at this University in a department other than that in which the honours study is undertaken for the honours degree – provided that at least half of the required modules for the degree in question are attended and passed at this university.

2.2. If there is overlap in the course content of the degree for which the student wishes to enrol or is enrolled and a degree already conferred, the Dean may not acknowledge any modules that form part of the degree already conferred.

## Additional requirements

1. Historical performance during prior studies will also be considered in selecting students. Specific attention will be given to modules repeated and duration of study.
2. The progress of all honours candidates is monitored biannually by the postgraduate coordinator/head of department. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

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a. Subject to the stipulations of G.22.1, G.23.2 and the Joint Statute, a Dean may acknowledge modules passed at another tertiary institution or at this University in a department other than that in which the honours study is undertaken for the honours degree – provided that at least half of the required modules for the degree in question are attended and passed at this university.

b. If there is overlap in the course content of the degree for which the student wishes to enrol or is enrolled and a degree already conferred, the Dean may not acknowledge any modules that form part of the degree already conferred.

# Examinations and pass requirements

In calculating marks, General Regulation G12.2 applies.
Subject to the provisions of General Regulation G.26, a head of a department determines, in consultation with the Dean

- when the honours examinations in his/her department will take place, provided that:

i. honours examinations which do not take place before the end of the academic  year, must take place no later than 18 January of the following year, and all examination results must be submitted to the Student Administration by 25 January; and

ii. honours examinations which do not take place before the end of the first semester, may take place no later than 15 July, and all examination results must be submitted to the Student Administration on or before 18 July.

- whether a candidate will be admitted to a supplementary examination, provided that a supplementary examination is granted, only once in a maximum of two prescribed semester modules or once in one year module;
- supplementary examinations (if granted) cover the same subject matter as was the case for the examinations;
- NB: For the purpose of this provision, the phrase "not sit for an examination more than twice in the same subject" as it appears in General Regulation G.18.2, implies that a candidate may not be admitted to an examination in a module, including a supplementary examination, more than three times.
- the manner in which research reports are prepared and examined in his department.

**NB**: Full details are published in each department's postgraduate information brochure, which is available from the head of department concerned. The minimum pass mark for a research report is 50%. The provisions regarding pass requirements for dissertations contained in General Regulation G.12.2 apply mutatis mutandis to research reports.

Subject to the provisions of General Regulation G.12.2.1.3, the subminimum required in subdivisions of modules is published in the study guides, which is available from the head of department concerned.

# Curriculum: Final year

**Minimum credits: 135**

## Core modules

### Linear models 710 (LMO 710)

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|---|---|
| **Module credits** | 15.00 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | WST 311, WST 312, WST 321 and WST 322 |
| **Contact time** | 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Academic organisation** | Statistics |
| **Period of presentation** | Semester 1 |

**Module content**

Projection matrices and sums of squares of linear sets. Estimation and the Gauss-Markov theorem. Generalised t- and F- tests.

### Multivariate analysis 710 (MVA 710)

| | |
|---|---|
| **Module credits** | 15.00 |
| **Service modules** | Faculty of Health Sciences |
| **Prerequisites** | WST 311, WST 312, WST 321and WST 322 |
| **Contact time** | 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Academic organisation** | Statistics |
| **Period of presentation** | Semester 1 |

**Module content**

Matrix algebra. Some multivariate measures. Visualising multivariate data. Multivariate distributions. Samples from multivariate normal populations. The Wishart distribution. Hotelling's $T^2$ statistic. Inferences about mean vectors.

### Research report: Mathematical statistics 795 (WST 795)

| | |
|---|---|
| **Module credits** | 30.00 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | WST 311, WST 312, WST 321 and WST 322 |
| **Language of tuition** | Module is presented in English |
| **Academic organisation** | Statistics |
| **Period of presentation** | Semester 1 and Semester 2 |

## Module content

Refer to the document: Criteria for the research management process and the assessment of the honours essays, available on the web:  www.up.ac.za under the Department of Statistics: postgraduate study.

# Elective modules

## Introduction to statistical learning 720 (EKT 720)

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|---|---|
| **Module credits** | 15.00 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | RAL 780 or WST 311, 312, 321, 322 |
| **Contact time** | 1 web-based period per week, 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Academic organisation** | Statistics |
| **Period of presentation** | Semester 2 |

## Module content

The emphasis is on the theoretical understanding and practical application of advances in statistical modelling. The following topics are covered: Single equation models: Nonparametric regression. Bootstrap procedures within regression analysis, k-nearest neighbour classification. Modelling categorical dependent variables - Logit/Probit models. Multiple outputs. Linear regression of an indicator matrix. Ridge regression. Non-linear regression modelling.  Some new developments in regression and classification.
Simultaneous equation models: Specification, identification and estimation of simultaneous equation models.

## Linear models 720 (LMO 720)

| | |
|---|---|
| **Module credits** | 15.00 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | LMO 710 |
| **Contact time** | 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Academic organisation** | Statistics |
| **Period of presentation** | Semester 2 |

## Module content

The singular normal distribution. Distributions of quadratic forms. The general linear model. Multiple comparisons. Analysis of covariance. Generalised linear models. Analysis of categorical data.

## Multivariate analysis 720 (MVA 720)

| | |
|---|---|
| **Module credits** | 15.00 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | MVA 710 |

| Contact time | 1 lecture per week |
|---|---|
| Language of tuition | Module is presented in English |
| Academic organisation | Statistics |
| Period of presentation | Semester 2 |

**Module content**

The matrix normal distribution, correlation structures and inference of covariance matrices. Discriminant analysis. Principal component analysis. The biplot. Multidimensional scaling. Exploratory factor analysis. Confirmatory Factor analysis and structural equation models.

## Parametric stochastic processes 720 (PNP 720)

| Module credits | 15.00 |
|---|---|
| Service modules | Faculty of Economic and Management Sciences |
| Prerequisites | WST 312 |
| Contact time | 1 lecture per week |
| Language of tuition | Module is presented in English |
| Academic organisation | Statistics |
| Period of presentation | Semester 2 |

**Module content**

Introduction to statistical measure theory. Queueing processes: M/M/1; M/M/S; M/G/1 queues and variants; limiting distribution of the queue length and waiting times. Queuing networks. Some stochastic inventory and storage processes.

## Sampling techniques 720 (SFT 720)

| Module credits | 15.00 |
|---|---|
| Service modules | Faculty of Natural and Agricultural Sciences |
| Prerequisites | BScHons: WST 311, WST 312, WST 321, WST 322; BComHons: STK 310, 320 |
| Contact time | 1 lecture per week |
| Language of tuition | Module is presented in English |
| Academic organisation | Statistics |
| Period of presentation | Semester 1 |

**Module content**

Simple random sampling. Estimation of proportions and sample sizes. Stratified random sampling. Ratio and regression estimators. Systematic and cluster sampling. Complex survey methodology. Handling of nonresponse.

## Statistical process control 780 (SPC 780)

| Module credits | 15.00 |
|---|---|

| Service modules | Faculty of Natural and Agricultural Sciences |
|---|---|
| Prerequisites | STK 310, 320 or WST 311, 312, 321, 322 |
| Contact time | 1 lecture per week |
| Language of tuition | Module is presented in English |
| Academic organisation | Statistics |
| Period of presentation | Semester 1 |

**Module content**

Quality control and improvement. Shewhart, cumulative sum (CUSUM), exponentially weighted moving average (EWMA) and Q control charts. Univariate and multivariate control charts. Determining process and measurement systems capability. Parametric and nonparametric (distribution-free) control charts. Constructing control charts using Microsoft Excel and/or SAS. Obtaining run-length characteristics via simulations, the integral equation approach, other approximate methods and the Markov-chain approach.

## Analysis of time series 720 (TRA 720)

| Module credits | 15.00 |
|---|---|
| Service modules | Faculty of Natural and Agricultural Sciences |
| Prerequisites | STK 310 and STK 320 |
| Contact time | 1 lecture per week |
| Language of tuition | Module is presented in English |
| Academic organisation | Statistics |
| Period of presentation | Semester 2 |

**Module content**

In this module certain basic topics relating to discrete, equally spaced stationary and non-stationary time series are introduced as well as the identification, estimation and testing of time series models and forecasting. Theoretical results are compared to corresponding results obtained from computer simulated time series.

## Distribution-free methods 710 (VMT 710)

| Module credits | 15.00 |
|---|---|
| Service modules | Faculty of Natural and Agricultural Sciences |
| Prerequisites | WST 311, WST 312, WST 321 and WST 322 |
| Contact time | 1 lecture per week |
| Language of tuition | Module is presented in English |
| Academic organisation | Statistics |
| Period of presentation | Semester 1 |

## Module content

A selection of: Nonparametric stochastic processes. Power and asymptotic power of distribution-free procedures. Theory and simulation. Asymptotic relative efficiency. Linear rank tests: Definition, properties and applications. Equal in distribution technique. Counting and ranking statistics. Introduction to one and two sample U-statistics. Permutation and distribution-free rank-like statistics. Multi-sample distribution-free tests, rank correlation and regression. Some nonparametric bootstrap and smoothing methods.

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The information published here is subject to change and may be amended after the publication of this information. The General Regulations (G Regulations) apply to all faculties of the University of Pretoria. It is expected of students to familiarise themselves well with these regulations as well as with the information contained in the General Rules section. Ignorance concerning these regulations and rules will not be accepted as an excuse for any transgression.