University of Pretoria Yearbook 2021

# BComHons Mathematical Statistics (07240244)

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|---|---|
| **Department** | Statistics |
| **Minimum duration of study** | 1 year |
| **Total credits** | 135 |
| **NQF level** | 08 |

## Admission requirements

1. Relevant BCom degree
2. Weighted average of at least 65% in at final-year level

## Other programme-specific information

Details of compilation of curriculum are available from the Head of the Department of Statistics as well as from the departmental postgraduate brochure.

A candidate must compile his/her curriculum in consultation with the head of department or his representative. It is also possible to include postgraduate modules from other departments. Refer to the Departmental website for further information.

## Examinations and pass requirements

In calculating marks, General Regulation G12.2 applies.
Subject to the provisions of General Regulation G.26, a head of 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 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 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/her department.

**NB**: Full details are published in each department's postgraduate information brochure, which is available from the relevant head of department. 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 relevant head of department.

# Curriculum: Final year

**Minimum credits: 135**

Choose five modules from the list of electives.

## Core modules

### Linear models 710 (LMO 710)

| | |
|---|---|
| **Module credits** | 15.00 |
| **NQF Level** | 08 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistic |
| **Contact time** | 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Department** | 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 |
| **NQF Level** | 08 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics |
| **Contact time** | 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Statistics |
| **Period of presentation** | Semester 1 or Semester 2 |

**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 orientation 796 (STK 796)

| | |
|---|---|
| **Module credits** | 0.00 |

| NQF Level | 08 |
|---|---|
| Service modules | Faculty of Economic and Management Sciences |
| Prerequisites | Admission to the relevant programme. |
| Contact time | Ad Hoc |
| Language of tuition | Module is presented in English |
| Department | Statistics |
| Period of presentation | Year |

**Module content**

A compulsory bootcamp must be attended as part of this module – usually presented during the last week of January each year (details are made available by the department ). The bootcamp will cover the basics of research to prepare students for the research component of their degree. The bootcamp should be done in the same year as registration for STK 795/WST 795. Each year of registration for the honours degree will also require the attendance of three departmental seminars. Students should ensure that their attendance is recorded by the postgraduate co-ordinator present at the seminars. The department approves the seminars attended. In addition, students are required to present their STK 795/WST 795 research in the department during the year of registration for these modules.

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

| Module credits | 30.00 |
|---|---|
| NQF Level | 08 |
| Prerequisites | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics |
| Language of tuition | Module is presented in English |
| Department | Statistics |
| Period of presentation | Year |

**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)

| Module credits | 15.00 |
|---|---|
| NQF Level | 08 |
| Service modules | Faculty of Natural and Agricultural Sciences |
| Prerequisites | RAL 780 or WST 311, 312, 321 |
| Contact time | 1 lecture per week, 1 web-based period per week |
| Language of tuition | Module is presented in English |

| Department | 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.

## Text and behavioural analytics 725 (EKT 725)

| Module credits | 15.00 |
|---|---|
| NQF Level | 08 |
| Prerequisites | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science |
| Contact time | 1 lecture per week |
| Language of tuition | Module is presented in English |
| Department | Statistics |
| Period of presentation | Semester 1 or Semester 2 |

**Module content**

Mixtures of distributions and regressions, frequentist and Bayes estimation. Latent components, soft allocation and belongings. Applications in unstructured data, including text data. Identification and interpretation of behavioural patterns.

## Linear models 720 (LMO 720)

| Module credits | 15.00 |
|---|---|
| NQF Level | 08 |
| 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 |
| Department | 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 |
| **NQF Level** | 08 |
| **Service modules** | Faculty of Health Sciences<br>Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | MVA 710 |
| **Contact time** | 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Statistics |
| **Period of presentation** | Semester 2 |

**Module content**

Discriminant analysis and classification. Principal component analysis. The biplot. Multidimensional scaling. Factor analysis. Probabilistic clustering.

# Parametric stochastic processes 720 (PNP 720)

| | |
|---|---|
| **Module credits** | 15.00 |
| **NQF Level** | 08 |
| **Service modules** | Faculty of Economic and Management Sciences |
| **Prerequisites** | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics |
| **Contact time** | 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Statistics |
| **Period of presentation** | Semester 1 or 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 |
| **NQF Level** | 08 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science |
| **Contact time** | 1 lecture per week |

| Language of tuition | Module is presented in English |
|---|---|
| Department | Statistics |
| Period of presentation | Semester 1 or Semester 2 |

#### Module content

Simple random sampling. Estimation of proportions and sample sizes. Stratified random sampling. Ratio and regression estimators. Systematic and cluster sampling. Introduction to spatial statistics. Spatial sampling – both model and design based approaches.

## Simulation and computation 710 (STC 710)

| Module credits | 15.00 |
|---|---|
| NQF Level | 08 |
| Prerequisites | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science |
| Contact time | 1 lecture per week |
| Language of tuition | Module is presented in English |
| Department | Statistics |
| Period of presentation | Semester 1 or Semester 2 |

#### Module content

Efficient programming, Monte Carlo simulation, sampling of discrete and continuous probability models, General transformation methods, Accept-reject methods, Monte Carlo integration, importance sampling, numerical optimisation, Metropolis-Hastings algorithm, GIBBS sampling.

## Capita selecta: Statistics 720 (STC 720)

| Module credits | 15.00 |
|---|---|
| NQF Level | 08 |
| Prerequisites | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science |
| Contact time | 1 lecture per week |
| Language of tuition | Module is presented in English |
| Department | Statistics |
| Period of presentation | Semester 1 and Semester 2 |

#### Module content

This module considers specific topics from the diverse field of statistics as deemed supportive towards the training of the cohort of scholars.

# Distribution-free methods 710 (VMT 710)

| | |
|---|---|
| **Module credits** | 15.00 |
| **NQF Level** | 08 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics |
| **Contact time** | 1 lecture per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Statistics |
| **Period of presentation** | Semester 1 or Semester 2 |

## 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.