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# University of Pretoria Yearbook 2016

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## BScHons Mathematical Statistics (02240191)

**Duration of study** 1 year

**Total credits** 135

### Programme 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.

#### Renewal of registration

- i. Subject to exceptions approved by the Dean, on the recommendation of the head of department, and in the case of distance education where the Dean formulates the stipulations that will apply, a student may not sit for an examination for the honours degree more than twice in the same module.
- ii. A student for an honours degree must complete his or her study, in the case of full-time students, within two years and, in the case of after-hours students, within three years of first registering for the degree and, in the case of distance education students, within the period stipulated by the Dean. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited extension of this period.

In calculating marks, General Regulation G.12.2 applies.

Apart from the prescribed coursework, a research project is an integral part of the study.

### Admission requirements

- A relevant bachelor's degree with Mathematical Statistics on the 300-level is required.
- For BScHons in Mathematical Statistics, an average mark of 65% or more
  - (i) in Mathematical statistics on the 300-level or
  - (ii) in an equivalent statistical module(s) at an accredited institution is required.
- In addition to passing of the core modules, WST 312 is also required as prerequisite for BScHons and BComHons in Mathematical Statistics.
- Students from other accredited institutions must comply with the same requirements based on equivalent modules at their institutions. In addition, students from other accredited institutions must also pass an entrance evaluation.
- Student numbers are limited to a maximum of 40, collectively over all honours programmes in the Department of Statistics. Selection is based on performance in the prior degree, conditional on ii and iii above.
- Historical performance during prior studies will also be considered in selecting students. Specific attention will be given to modules repeated and duration of study.
- Any additional entrance requirements as specified by the head of department in consultation with the



departmental postgraduate selection committee.

## Promotion to next study year

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.

## Pass with distinction

The BScHons degree is awarded with distinction to a candidate who obtains a weighted average of at least 75% in all the prescribed modules and a minimum of 65% in any one module.



## Curriculum: Final year

Minimum credits: 135

### Core modules

#### Linear models 710 (LMO 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** 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 321 and WST 322

**Contact time** 1 lecture per week

**Language of tuition** 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** 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](http://www.up.ac.za) under the Department of Statistics: postgraduate study.

## Elective modules

### Introduction to statistical learning 720 (EKT 720)

<b>Module credits</b>	15.00
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	RAL 780
<b>Contact time</b>	1 web-based period per week, 1 lecture per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Statistics
<b>Period of presentation</b>	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)

<b>Module credits</b>	15.00
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	LMO 710
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Statistics
<b>Period of presentation</b>	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)

<b>Module credits</b>	15.00
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	MVA 710



**Contact time** 1 lecture per week

**Language of tuition** 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** 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. Queueing 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** 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



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<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	BScHons: WST 311, WST 312, WST 321, WST 322; BComHons in Statistics: STK 310, 320
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Statistics
<b>Period of presentation</b>	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)

<b>Module credits</b>	15.00
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	STK 310 and STK 320
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Statistics
<b>Period of presentation</b>	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)

<b>Module credits</b>	15.00
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	WST 311, WST 312, WST 321 and WST 322
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Statistics
<b>Period of presentation</b>	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.