

# University of Pretoria Yearbook 2020

## BScHons Mathematical Statistics (02240192)

**Minimum duration of study** 1 year

**Total credits** 135

**NQF level** 08

### Programme information

#### Renewal of registration

- Subject to exceptions approved by the Dean, on the recommendation of the relevant head of department, a student may not sit for an examination for the honours degree more than twice in the same module.
- 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. Under special circumstances, the Dean, on the recommendation of the relevant 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 at third-year level is required. A relevant degree must cover compatible content of required degrees at the University of Pretoria.
- For BScHons (Mathematical Statistics) an average mark of 65% or more is required in:
  - mathematical statistics at third-year level, or
  - an equivalent statistics module(s) at an accredited institution.
- 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.
- Historical performance during prior studies will also be considered in selecting students. Specific attention will be given to modules repeated and duration of study.
- A compulsory language proficiency test must be completed at UP. The postgraduate committee of the department will help with the facilitation of the test through the universities language unit. It may be required, based on the outcome, that a student does additional language courses.
- Applications must include full academic transcripts from undergraduate to current level. SAQA evaluation documentation is required for international applications and on request for students with qualifications from South African institutions.

## 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 credits: 60

Elective credits: 75

### 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

**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

**Service modules** Faculty of Natural and Agricultural Sciences

**Prerequisites** WST 311, WST 312, WST 321

**Contact time** 1 lecture per week

**Language of tuition** Module is presented in English

**Department** 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 orientation 796 (STK 796)

**Module credits** 0.00

**Service modules** Faculty of Economic and Management Sciences

**Prerequisites** Admission to the relevant programme.

<b>Contact time</b>	Ad Hoc
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Statistics
<b>Period of presentation</b>	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)

<b>Module credits</b>	30.00
<b>Prerequisites</b>	WST 311, WST 312, WST 321
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Statistics
<b>Period of presentation</b>	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 or WST 311, 312, 321
<b>Contact time</b>	1 lecture per week, 1 web-based period per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</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.

## Text and behavioural analytics 725 (EKT 725)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	STK 353
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Statistics
<b>Period of presentation</b>	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)

<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>	Module is presented in English
<b>Department</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 Health Sciences Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	MVA 710
<b>Contact time</b>	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

**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

**Department** 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** WST 311, WST 312, WST 321, or STK 310, 320.

**Contact time** 1 lecture per week

**Language of tuition** Module is presented in English

**Department** 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. Introduction to spatial statistics. Spatial sampling – both model and design based approaches.

### Simulation and computation 710 (STC 710)

**Module credits** 15.00

**Prerequisites** STK 353

**Contact time** 1 lecture per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 1

#### 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

**Prerequisites** STK 353

**Contact time** 1 lecture per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 1

#### Module content

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

### Linear mixed models 781 (STK 781)

**Module credits** 15.00

**Service modules** Faculty of Natural and Agricultural Sciences

**Prerequisites** BScHons and BComHons in Mathematical Statistics: WST 311; BComHons Statistics: STK 310, STK 320.

**Contact time** 1 lecture per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 2

#### Module content

Specification of linear mixed model, model assumptions, estimation (REML and ML), diagnostics, hypothesis tests, interpretation of parameter estimates, calculating predicted values. Specific models: two- and three-level models for clustered data, intraclass correlation coefficients, repeated measures data, random coefficient models for longitudinal data, models for clustered longitudinal data, models for data with crossed random factors. Using statistical software to analyse LMMs.

### Distribution-free methods 710 (VMT 710)

**Module credits** 15.00

**Service modules** Faculty of Natural and Agricultural Sciences

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<b>Prerequisites</b>	WST 311, WST 312, WST 321
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</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.