University of Pretoria Yearbook 2020

BScHons Statistics and Data Science (02240193)

Minimum duration of study	1 year
Total credits	135
NQF level	08

Admission requirements

- A relevant bachelor's degree with Statistics at third-year level is required. A relevant degree must cover compatible content of required degrees at the University of Pretoria. An average mark of 65% or more is required in: 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.

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/her representative. It is also possible to include postgraduate modules from other departments. Refer to the Departmental website for further information.
- All honours students in Statistics/Mathematical Statistics must enrol for STK 796 which is a compulsory but non-credit-bearing module.
- An external student who does not fully meet the requirements to enter this degree can register, with permission from the head of department and the postgraduate committee for STK 310, 320, 353 and WST 212 in year 1 full-time for non-degree purposes. Provided a 65% average for these is achieved, the student can then complete the BScHons (Statistics) modules in year 2.

Curriculum: Final year

Minimum credits: 135

Core credits: 75

Elective credits: 60 (choose four electives from the list)

Core modules

Introduction to statistical learning 720 (EKT 720)

Module credits	15.00
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.

Multivariate techniques 720 (MET 720)

Module credits	15.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	STK 310 and STK 320. This prerequisite cannot be replaced with any WST modules.
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 2

Module content

Point and Interval estimation. Sampling distributions, central limit theorem, simulations and Bootstrap. Bayesian inference, posterior distribution, Hypotheses testing using confidence intervals, ratio tests, simulated null distributions and power function.

Regression analysis 780 (RAL 780)

Module credits	15.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	STK 310 and STK 320. This prerequisite cannot be replaced with any WST modules.
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 1

Module content

Matrix methods in statistics. Simple and multiple regression models. Sums of squares of linear sets. Generalised t- and F-tests. Residual analysis. Diagnostics for leverage, influence and multicolinearity. Indicator variables. Regression approach to analysis of variance. Weighted least squares. Theory is combined with practical work.

Research report: Statistics 795 (STK 795)

Module credits	30.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	STK 310, STK 320, RAL 780
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.

Research orientation 796 (STK 796)

Module credits	0.00
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.

Elective modules

Text and behavioural analytics 725 (EKT 725)

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 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.

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.

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
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	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.

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.