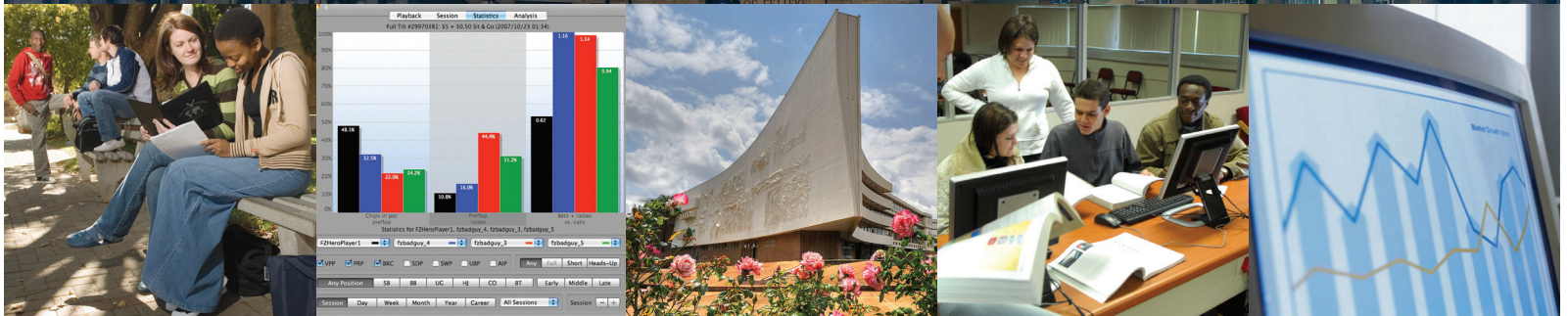


Faculty of Economic and Management Sciences
Faculty of Natural and Agricultural Sciences
Department of Statistics
Postgraduate study



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Why do postgraduate studies in Statistics?

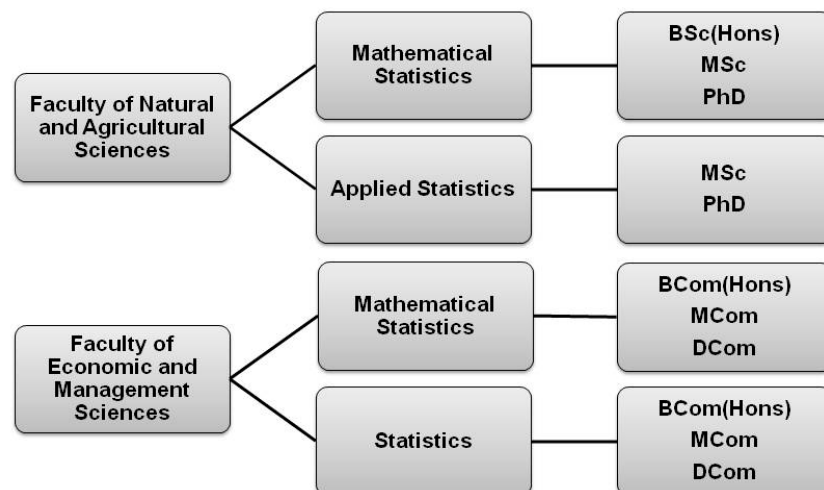
"I keep saying the sexy job in the next ten years will be statisticians. People think I'm joking, but who would've guessed that computer engineers would've been the sexy job of the 1990s? The ability to take data—to be able to understand it, to process it, to extract value from it, to visualize it, to communicate it—that's going to be a hugely important skill in the next decades, not only at the professional level but even at the educational level for elementary school kids, for high school kids, for college kids. Because now we really do have essentially free and ubiquitous data. So the complimentary scarce factor is the ability to understand that data and extract value from it."

-Hal Varian, professor of Information Sciences, Business and Economics at the University of California at Berkeley, and Google's chief economist, in The McKinsey Quarterly, January 2009.

A career in Statistics is a highly rewarding one. Statisticians' skills are applied in actuarial science, atmospheric science, bioinformatics, biomathematics, biostatistics, economics and econometrics, environmental sciences, financial engineering, government service, industrial statistics, medicine, meteorology, official statistics, operational research, pharmaceutical research, public health, quality improvement, reliability, risk analysis, risk management and insurance, social statistics and survey research, amongst others.

A master's degree or PhD/DCom is very helpful and often required or recommended for higher level positions in industry. The **Department of Statistics at the University of Pretoria** offers an extensive and flexible range of postgraduate programmes.

The following postgraduate programmes and disciplines are presented (in collaboration with other departments):



Honours Programmes

General

The honours degree is presented in Mathematical Statistics and in Statistics. Apart from the modules presented by the Department of Statistics, it is also possible to include postgraduate modules from other departments e.g. Mathematics, Economics, etc. Regarding the number of credits from other departments the following is applicable:

- a. The department must be a “related” department.
- b. The student must hand in a proposal to the head of the department for approval at his/her own discretion.
- c. At most one of the six modules (required for the degree) can be replaced with the understanding that compulsory modules cannot be replaced and thus only elective modules are replaceable.

Normally a module is only offered once a year in any one semester, see program composition for presentation period. A candidate must compile his/her programme in consultation with the head of the department or the department’s postgraduate committee.

Admission requirements

- a. A relevant Bachelor’s degree with Mathematical Statistics or Statistics on the 300 level is required (Economics on the 300 level is also required for BCom(Hons) in Statistics specialising in Economic Statistics).
- b. For BSc(Hons) and BCom(Hons) in Mathematical Statistics, an average mark of 65% or more in Mathematical Statistics on the 300 level.
- c. In addition to passing of core modules, WST312 is also required as prerequisite for BSc(Hons) and BCom(Hons) in Mathematical Statistics.
- d. For BCom(Hons) in Statistics an average mark of 65% in Statistics 310 and 320 respectively is required.
- e. For BCom(Hons) in Statistics, specializing in Economic Statistics, an average mark of 65% or more in Economics on the 300 level is required.
- f. 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 pass an entrance evaluation as well as a language proficiency test.
- g. Student numbers are limited to a maximum of 40, collectively over all Honours Programs in the Department of Statistics.
- h. Historical performance during prior studies will also be considered in selecting students. Specific attention will also be given to modules repeated and duration of study.
- i. Any additional entrance requirements as specified by the head of the department in consultation with the departmental postgraduate selection committee.

Duration of programme

The minimum duration is one year of full-time study or two years of part-time study. A student must complete his or her study for an honours degree, in the case of full-time students, within two years from the first examination to the final examination and in the case of part-time students, within three years from the first examination to the final examination. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited extension of this period.

Promotion

The progress of all honours candidates is monitored biannually by the department's postgraduate committee and head of department. Subject to exceptions approved by the dean, on recommendation of the head of the department, a student may not enter for the honours' examination in the same subject more than twice and a candidate's study may be terminated if the progress is subsequently deemed unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed minimum period. If a candidate has failed more than three (3) different subjects, he/she will be dismissed from the degree.

Programme composition

The available programs with their compositions are given below.

- **BSc(Hons) in Mathematical Statistics (120 credits) and BCom(Hons) in Mathematical Statistics (120 credits):**

First Semester	Second Semester
Compulsory modules (60 credits)	
LMO710 Linear Models (15)	
MVA710 Multivariate Analysis (15)	
WST795 Research Report: Mathematical Statistics (30)	
Elective modules (choose 4) (60 credits)	
SFT720 Sampling Techniques (15)	LMO720 Linear Models (15)
VMT710 Distribution-free Methods (15)	MVA720 Multivariate Analysis (15)
SPC780 Statistical Process Control (15)	PNP720 Parametric Stochastic Processes (15)
	EKT720 Introduction to Statistical Learning (15)
<p>The student must complete the compulsory modules LMO710 and MVA710 in the first semester and the compulsory essay over the whole duration of a year. It is suggested the student weight the four elective modules either 2:2 or 3:1 in order to allow sufficient time to complete the essay in the second semester (the essay work is weighted one third and two thirds over the two semesters respectively).</p>	

In the case of students from other universities TRA 720 (Time series Analysis 720) with credits (15) may be taken as optional module in the second semester for **BSc(Hons) in Mathematical Statistics** or **BCom(Hons) in Mathematical Statistics** students subject to the approval by the head of the department.

- **BCom(Hons) in Statistics** (120 credits):

In this programme students can choose between two options, namely **Economic Statistics** or **Survey Statistics**.

Economic Statistics option:

First Semester	Second Semester
Compulsory modules (120 credits)	
MET720 Multivariate Techniques (15)	EKT720 Introduction to Statistical Learning (15)
MIE780 Microeconomics (15)	TRA720 Time Series Analysis (15)
MEK780 Macroeconomics (15)	
RAL780 Regression Analysis (15)	
STK795 Research Report: Statistics (30)	
Note that the essay work is weighted one third and two thirds over the two semesters respectively.	

Survey Statistics option:

First Semester	Second Semester
Compulsory modules (120 credits)	
MET720 Multivariate Techniques (15)	EKT720 Introduction to Statistical Learning (15)
SFT720 Sampling Techniques (15)	TRA720 Time Series Analysis (15)
SPC780 Statistical Process Control (15)	
RAL780 Regression Analysis (15)	
STK795 Research Report: Statistics (30)	
Note that the essay work is weighted one third and two thirds over the two semesters respectively.	

Notes

- a. Some of the second semester modules have first semester modules as prerequisites, as explicated in the section "Particulars regarding the contents of modules."
- b. Tests and assignments may be taken into account in the determination of the final mark in each module. Exam entrance may be enforced in each module on discretion of the lecturer.
- c. Regulation G.17 applies with regard to examination registration.
- d. Examinations in a module will take place during one of the official university examination time periods. In order to pass the programme, a final mark of at least 50% in each of the prescribed modules must be obtained. The honours examination can be divided into at most four sections which must each be written in a time period of at most three weeks and over at most four semesters.
- e. Note that the Department of Statistics does not provide supplementary nor sick exams for any postgraduate modules.

Research Report: WST 795 and STK 795

- a. The total time spent on the essay must be at least double that of any module. The submission date of the essay is the middle of November. The dates for the essay presentations will be set mid-year. All students must present on these dates. No exceptions.
- b. Refer to the document: **Honours Research Report Course Information** available on the web in 2014: www.up.ac.za under the Department of Statistics -> Postgraduate Studies. Registration of topic has to be done at the head of the Department's office before end of February 2014; details will be conveyed at the first postgraduate meeting in 2014 and a number of topics will be provided.
- c. The first 9 weeks of the semester will entail a group class for the essay comprising 10 credits of the total 30 credits. These classes are compulsory. Details in the document mentioned above. The remainder of the year will involve research and the essay write-up together with a supervisor from the department, and comprises the remaining 20 credits.

Particulars regarding the contents of modules

- **Distribution-free Methods 710 (VMT 710)**

Prescribed book:

- Randles, R.H. and Wolfe, D.A.: *Introduction to the Theory of Nonparametric Statistics* (John Wiley, 1979)

Curriculum:

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.

Prerequisite: [WST 311, 312, 321 and 322]

- **Introduction to Statistical Learning 720 (EKT 720)**

Prescribed book:

- Gujarati, D.N.: *Basic Econometrics* (Second edition) (McGraw-Hill, 1988)
- Intriligator, M.D.; Bodkin G.C. and Hsiao, C.: *Econometric Models, Techniques & Applications* (Prentice Hall, Inc.,1996)
- Hastie, T; Tibshirani, R and Friedman, J: *The elements of Statistical learning* (Second edition) (Springer 2009)

Recommended books:

- Pindyck, R. S. and Rubinfeld, D.L.: *Econometric Models and Economic Forecasts* (Fourth edition) (McGraw-Hill, 1991)
- Draper, N and Smith, H: *Applied Regression analysis* (John Wiley, 1998)

Curriculum:

The emphasis is on the theoretical understanding and practical application of advanced 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. Factor analysis regression. Some new developments in regression and classification.

Simultaneous equation models: Specification, identification and estimation of simultaneous equation models.

Prerequisites: [BCom(Hons) Statistics: RAL 780]

- **Linear Models 710 (LMO 710)**

Recommended book:

- Searle, S.R.: *Linear Models* (John Wiley, 1971)

Curriculum:

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

Prerequisite: [WST 311, 312, 321 and 322]

- **Linear Models 720 (LMO 720)**

Recommended book:

- Searle, S.R.: *Linear Models* (John Wiley, 1971)

Curriculum:

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

Prerequisite: [LMO 710]

- **Macroeconomics (MEK 780)**

Refer to the Department of Economics for details.

- **Microeconomics (MIE 780)**

Refer to the Department of Economics for details.

- **Multivariate Analysis 710 (MVA 710)**

Prescribed book:

- Johnson, R.A. and Wichern, D.W.: *Applied Multivariate Statistical Analysis* (Sixth edition) (Prentice Hall)

Recommended books:

- Morrison, Donald, F.: *Multivariate Statistical Methods*. (Fourth edition)(Thomson)

Curriculum:

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

Prerequisites: [WST 311, 312, 321 and 322]

- **Multivariate Analysis 720 (MVA 720)**

Prescribed book:

- Everitt, B. and Torsten Hothorn, T. *An introduction to applied multivariate analysis with R*

Recommended books:

- Johnson, R.A. and Wichern, D.W.: *Applied Multivariate Statistical Analysis* (Sixth edition) (Prentice Hall).

Curriculum:

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.

Prerequisite: [MVA 710]

- **Multivariate Techniques 720 (MET 720)**

Prescribed book:

- Bain, L.J. and Engelhardt, M.: *Introduction to Probability and Mathematical Statistics* (Second Edition) (PWS-Kent Publishing Company, 1992)

Curriculum

Estimation: methods of moments and maximum likelihood. Cramer-Rao inequality, mean squared error, loss and risk functions, Bayes estimators. Sufficient statistics, completeness, the exponential class. Tests of statistical hypothesis: power function, critical region and Neyman-Pearson lemma.

Prerequisites: [STK 310, 320]

- **Parametric Stochastic Processes 720 (PNP 720)**

Recommended book:

- Baht, U.N: *An Introduction to Queueing Theory: Modelling and Analysis in Applications* (Birkhäuser, 2008).

Curriculum:

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.

Prerequisite: [WST 312]

- **Regression Analysis 780 (RAL 780)**

Prescribed book:

- Kutner, Nachtsheim and Neter (2004). *Applied Linear Regression Models*, 4th edition, Mc Graw Hill

Recommended books:

- Freund, J.F., Wilson, J.W. and Ping, S. (2006). *Regression Analysis: Statistical Modeling of a Response Variable*, 2nd edition, Elsevier.
- Freund, J.F. and Ramon, C.L. *SAS System for Regression*, 3rd edition, Cary, N.C. : SAS Institute.
- Mendenhall, W. and Sincich, T.: *A second module in business statistics: Regression Analysis* 6th edition, Macmillan
- Montgomery, D.C. and Peck, E.A.: *Introduction to Linear Regression Analysis*, 2nd edition, John Wiley.

Curriculum:

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

Prerequisites: [STK 310, 320]

- **Sampling Techniques 720 (SFT 720)**

Prescribed book:

- Lohr, S.L.: *Sampling: Design and Analysis* (2nd edition) (Brooks/Cole, Cengage Learning, 2010)

Curriculum:

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.

Prerequisites: [BSc(Hons) and BCom(Hons) Mathematical Statistics: WST 311, 312, 321] [BCom(Hons) Statistics: STK 310, 320]

- **Statistical Process Control 780 (SPC 780)**

Prescribed book:

- Montgomery, D.C.: *Statistical Quality Control: A Modern Introduction* (Sixth Edition - International Student Version) (John Wiley, 2009)

Curriculum:

Quality control and improvement. Shewhart, cumulative sum (CUSUM), exponentially weighted moving average (EWMA) and Q 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.

Prerequisites: [BSc(Hons) and BCom(Hons) Mathematical Statistics: WST 311, 312, 321 and 322] [BCom(Hons) Statistics: STK 310, 320]

- **Time Series Analysis 720 (TRA 720)**

Recommended book:

- Cryer, J.D. & Chan, K. S.: *Time Series Analysis: With Applications in R* (Second edition) (Springer; 2008)

Curriculum:

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.

Prerequisites: [STK 310, 320] Students having completed WST321 are ineligible for TRA720.

Master's Programmes

General

The Master's degree is presented in the following disciplines: Mathematical Statistics, Applied Statistics and Statistics.

Students must consult their relevant faculty to ascertain themselves with the applicable submission dates for the dissertation, essay or thesis. Students must frequent themselves with the regulations regarding the submission of dissertations, essays and theses in order to comply with the requirements of their host faculty.

The following degrees are offered:

- **MSc in Mathematical Statistics and MSc in Applied Statistics**
- **MCom in Mathematical Statistics and MCom in Statistics**

Admission Requirements

- a. A relevant honours degree as indicated is required:

Programme:	Prerequisite:
MSc in Mathematical Statistics	BSc(Hons) in Mathematical Statistics
MSc in Applied Statistics	BSc(Hons) in Mathematical Statistics
MCom in Mathematical Statistics	BCom(Hons) in Mathematical Statistics
MCom in Statistics	BCom(Hons) in Statistics

- b. For MSc (Mathematical Statistics) and MSc (Applied Statistics) an average mark of 65% or more in BSc(Hons) Mathematical Statistics.
- c. For MCom (Mathematical Statistics) and MCom (Statistics) an average mark of 65% or more in the respective BCom(Hons).
- d. 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 pass an entrance evaluation as well as a language proficiency test.
- e. Student numbers are limited to a maximum of 20, collectively over all Master's Programs in the Department of Statistics.
- f. Historical performance during prior studies will also be considered in selecting students. Specific attention will also be given to modules repeated and duration of study.
- g. Admission is also subject to the availability of supervisory capacity in the field of specialisations available in the Department.
- h. The research proposal of applicants should be in line with the research focus of the department.
- i. Any further additional entrance requirements as specified by the head of the department in consultation with the department's postgraduate selection committee.
- j. The head of department reserves the right to prescribe additional modules.

Duration

As long as progress is satisfactory, renewal of registration of a master's student will be accepted for a second year of study in the case of a full-time student. Renewal of registration for a third and subsequent years for a full-time student will only take place when Student Administration of the Faculty receives a written motivation (including a time line (Gantt chart) indicating potential completion date) that is supported by the Head of Department and Postgraduate Committee.

Promotion

The progress of all master's candidates is monitored biannually by the supervisor and the department's postgraduate committee. A candidate's study will be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period. Subject to exceptions approved by the dean, on recommendation of the head of the department, a student may not enter for the master's examination in the same subject more than twice. As soon as a student has failed two (2) different modules, the student will be dismissed from the postgraduate program.

Notes

- a. Attendance of a the first 9 weeks of the honours research component, if not completed during the honours programme, at the start of the Master's program. This will be for non-degree purposes.
- b. **The completion of the module work is a prerequisite for commencing with the dissertation.** The student must identify a possible supervisor and topic (see focus area list) near the end of coursework (2 subjects completed with satisfactory performance). This information must be communicated to Ms Ferreira (carin.ferreira@up.ac.za) and must be approved by the Postgraduate Committee.
- c. The MEMORANDUM OF UNDERSTANDING (obtainable from the faculty) must be signed by both the candidate, the supervisor(s) and the department's postgraduate committee and be submitted to the office of the Head of Student Administration within two months after the date of registration for the research component of the programme. This document must first go through the departments' postgraduate committee. The committee will also sign the document (in collaboration with the HOD) and enters into the agreement with the student as well. The Department of Statistics requires the following additional procedures for this document:
 - (i) Title: **Department of Statistics Postgraduate MoU between the student, supervisor and the Department of Statistics**
 - (ii) Under supervisor's expectations the following additional requirements should be added:
 - The regular scheduled meetings must occur a minimum of every 2 months (not the 3 months indicated in the document). More frequent meetings are highly recommended to ensure throughput.
 - The candidate is required to present at least 2 seminars a year to the department and its students on the progress of the work.
 - The student must ensure sufficient progress in made so that the supervisor can report positively to the postgraduate committee each quarter.
 - (iii) Under candidate's expectations the following additional requirements should be added:

- The supervisor must submit reports to the postgraduate committee on the student's progress each quarter to ensure visibility of the student's progress.
- d. On completion of the research component of the Master's degree a student must present a final departmental seminar.
- e. Tests and assignments may be taken into account in the determination of the final mark in each of the lectured modules. Exam entrance may be enforced in these modules on discretion of the lecturer.
- f. Note that the Department of Statistics does not provide supplementary nor sick exams for any postgraduate modules.
- g. Examinations in modules take place during one of the official university examination time periods.

Programme composition (Total credits required: 180)

A candidate must compile his/her curriculum in consultation with the department's postgraduate committee. The Master's degree is awarded on the grounds of a dissertation and additional prescribed module work. A pass mark must be obtained in the dissertation as well as in the additional module work.

For:

- **MSc in Mathematical Statistics and MSc in Applied Statistics**

The Mathematical Statistics option involves research on theoretically identified aspects with applied demonstrations and examples of the concepts. The applied option involves research into theoretical aspects identified through specific application needs and requirements. The applied option doesn't allow only for standard application of known statistical techniques on data sets. The applied statistics option involves more application based research with some theoretical work, that is, new statistical techniques for a specific application. The most appropriate option for the dissertation must be discussed with the head of the department.

MVA880	Statistical learning (20)
STK880	Capita selecta: Statistics (20)
TRA880	Analysis of time series (20)
TRG880	Applied regression analysis (20)
WST895	Mini-dissertation: Mathematical statistics (100)

- **MCom in Mathematical Statistics**

Dissertation (07250341)

WST890 Dissertation (180)

or

Coursework (07250342)

WST895	Mini-dissertation: Mathematical Statistics (100)
MVA880	Statistical learning (20)
STK880	Capita selecta: Statistics (20)
TRA880	Analysis of time series (20)
TRG880	Applied regression analysis (20)

- **MCom in Statistics**

- ***Dissertation (07250061)***

- STK890 Dissertation (180)

- or

- ***Coursework (07250062)***

- STK895 Mini-dissertation (100)

- MVA880 Statistical Learning (20)

- STK880 Capita selecta: Statistics (20)

- TRA880 Analysis of time series (20)

- TRG880 Applied regression analysis (20)

Particulars regarding the contents of modules (MCom and MSc)

- **Applied Regression Analysis (TRG 880)**

- Prescribed book:

- ➤ Kutner, MH; Neter, J and Nachtsheim, WL: *Applied Linear Statistical Models* (Fifth edition) (McGraw-Hill Education, 2004)

- Curriculum:

- Introduction: simple linear regression, regression as Linear Model, matrices in Regression. Regression Diagnostics: diagnostics for cases and variables, choosing a model, transforming the variables. Nonlinear Regression. Logistic Regression and related models. Ridge Regression. Generalized Linear Models.

- **Statistical Learning (MVA 880)**

- Prescribed book:

- ➤ Paolo Giudici : *Applied Data Mining* (John Wiley ,2003)
 - ➤ Hastie, T; Tibshirani, R and Friedman, J: *The elements of Statistical learning* (Second edition) (Springer, 2009)

- Curriculum:

- Supervised and unsupervised methods, including computational methods, within the broader context of Data mining.

- Supervised learning: Linear methods for regression, classification and prediction. Basis Expansions, Regularization, Smoothing, Additive models and Support Vector Machines.

- Unsupervised learning: Clustering, principal components, dimensional reduction.

- Data methods: Organisation of data and exploratory data analysis.

- **Capita Selecta : Statistics (STK 880)**

- Recommended book:

- ➤ Montgomery, D.C.: *Statistical Quality Control: A Modern Introduction* (5th or later edition - International Student Version) (John Wiley, 2009). It is not compulsory to buy the textbook.

- Curriculum:

- The module is primarily article based and covers the most recent literature that discusses the developments and research in, for example, Shewhart charts, Exponentially Weighted Moving Average (EWMA) charts, Cumulative Sum (CUSUM) charts, Q-charts, Parametric and

Nonparametric charts, Univariate and Multivariate charts, Phase I and Phase II control charts, Profile monitoring and other research topics.

▪ **Time Series Analysis (TRA 880)**

Prescribed book:

- Hamilton, J.D. : *Time Series Analysis* (First edition) (Princeton University Press, 1994)

Recommended books:

- Box, G.E.P., Jenkins, G.M. & Reinsel, G.C.: *Time Series Analysis: Forecasting and Control* (Fourth edition) (John Wiley, 2008)
- Cryer, J.D. & Chan, K.-S.: *Time Series Analysis: With Applications in R* (Second edition) (Springer, 2008)
- Gilgen, H. : *Univariate Time Series in Geosciences: Theory and Examples* (First edition) (Springer, 2005)
- Lütkepohl, H.: *New Introduction to Multiple Time Series Analysis* (Springer, 2007)
- Palma, W. : *Long-Memory Time Series: Theory and Methods* (First edition) (John Wiley-Interscience, 2007)
- Wei, W.W.S.: *Time Series Analysis: Univariate and Multivariate Methods* (Second edition) (Addison Wesley, 2005)

Curriculum:

Difference equations. Lag operators. Stationary ARMA processes. Maximum likelihood estimation. Spectral analysis. Vector processes. Non-stationary time series. Long-memory processes.

Prerequisite: [WST 321 or TRA 720]

Doctoral Programme

General

The Doctoral degree is presented in the following disciplines: Mathematical Statistics, Applied Statistics and Statistics. The study is performed under the supervision of a promoter. The topic is determined and the promoter is appointed in consultation with and subject to the approval of the head of the department and the department's postgraduate committee. The topic of the thesis to be submitted must be approved by the Dean on recommendation of the head of the department. The Mathematical Statistics option involves research on theoretically identified aspects with applied demonstrations and examples of the concepts. The applied option involves research into theoretical aspects identified through specific application needs and requirements. The applied option doesn't allow only for standard application of known statistical techniques on data sets. The applied statistics option involves more application based research with some theoretical work, that is, new statistical techniques for a specific application. The most appropriate option for the dissertation must be discussed with the head of the department.

Admission Requirements

- a. A relevant Master's degree in Mathematical Statistics or Applied Statistics is required.
- b. For PhD (Mathematical Statistics) and PhD (Applied Statistics) an average mark of 65% or more in the MSc Mathematical Statistics or MSc Applied Statistics.
- c. For DCom (Mathematical Statistics) and DCom (Statistics) an average mark of 65% or more in the MCom Mathematical Statistics or MCom Statistics.
- d. 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 pass an entrance evaluation as well as a language proficiency test.
- e. Student numbers are limited to a maximum of 10, collectively over all Doctoral Programs in the Department of Statistics.
- f. Historical performance during prior studies will also be considered in selecting students. Specific attention will be given to modules repeated and duration of study.
- g. Admission is also subject to the availability of supervisory capacity in the field of specialisations available in the Department.
- h. Additional entrance requirements as specified by the head of the department.

Duration

As long as progress is satisfactory, renewal of registration of a doctoral student will be accepted for a second year and third year of study in the case of a full-time student. Renewal of registration for a fourth and subsequent years for a full-time student will only take place when Student Administration of the Faculty receives a written motivation (including a time line (Gantt chart) indicating potential completion date) that is supported by the head of department and department's postgraduate committee.

Promotion

The progress of all doctoral candidates is monitored biannually by the supervisor and the postgraduate committee. 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. The regulations of the university with regard to doctoral degree studies apply.

Programme composition

A candidate must complete a thesis in one of several fields in Applied Statistics, Mathematical Statistics or Statistics in which research is actively being done within the Department.

Notes

The MEMORANDUM OF UNDERSTANDING (obtainable from the faculty) must be signed by both the candidate, the supervisor(s) and the postgraduate committee and be submitted to the office of the Head of Student Administration within two months after the date of registration for the research component of the programme. This document must first go through the departments' Postgraduate Committee. The Postgraduate committee will also sign the document (in collaboration with the HOD) and enters into the agreement with the student as well. The Department of Statistics requires the following additional procedures for this document:

- (i) Title: **Department of Statistics Postgraduate MoU between the student, supervisor and the Department of Statistics**
- (ii) Under supervisor's expectations the following additional requirements should be added:
 - a. The regular scheduled meetings must occur a minimum of every 2 months (not the 3 months indicated in the document). More frequent meetings are highly recommended to ensure throughput.
 - b. The candidate is required to present at least 2 seminars a year to the department and its students on the progress of the work.
 - c. The student must ensure sufficient progress in made so that the supervisor can report positively to the postgraduate committee each quarter.
- (iii) Under candidate's expectations the following additional requirements should be added:
 - a. The supervisor must submit reports to the postgraduate committee on the student's progress each quarter to ensure visibility of the student's progress.

Master's and Doctoral degree research studies focus areas:

- Statistical Process Control
- Data Mining
- Generalised Linear Models
- Linear Models
- Optimal Design of experiments
- GLMMs for count data
- Image Processing
- Stochastic processes
- Official Statistics
- Categorical Data Analysis
- Statistics Education
- Beyond Known Distributions
- Time Series Analysis
- Statistical Consultation
- Statistics in Sport

Further information

There are excellent opportunities for postgraduate bursaries. For postgraduate bursaries or any other information contact the Department of Statistics. See also Departmental website.

All postgraduate programme inquiries please contact Ms Carin Ferreira: Carin.ferreira@up.ac.za

Applications are handled by Mr S.M. Millard: sollie.millard@up.ac.za (for students in the Faculty of Economic and Management Sciences) and Dr F.H.J. Kanfer: frans.kanfer@up.ac.za (for students in the Faculty of Natural and Agricultural Sciences).

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Website: Department of Statistics at <http://www.up.ac.za/>

StatsSA celebrates 100 years in 2014.

South Africa will celebrate the success of statistics for 100 years!

"On this first World Statistics Day I encourage the international community to work with the United Nations to enable all countries to meet their statistical needs."

BAN KI-MOON

Secretary-General of the United Nations

Message on World Statistics Day, 20-10-2010