University of Pretoria Yearbook 2020

BSc Actuarial and Financial Mathematics (02133395)

Minimum duration of study	3 years
Total credits	432
NQF level	07

Admission requirements

- The following persons will be considered for admission: a candidate who is in possession of a certificate that is deemed by the University to be equivalent to the required Grade 12 certificate with university endorsement, a candidate who is a graduate from another tertiary institution or has been granted the status of a graduate of such an institution, and a candidate who is a graduate of another faculty at the University of Pretoria.
- Life Orientation is excluded in the calculation of the Admission Point Score (APS).
- Grade 11 results are used for the conditional admission of prospective students. Final admission is based on the Grade 12 results.

Minimum requirements				
Achievement level				
English Home Language or English First Additional Language		**Mathematics**		**APS**
NSC/IEB	AS Level	NSC/IEB	AS Level	
5	C	7	A	**36**

* Cambridge A level candidates who obtained at least a D in the required subjects, will be considered for admission. International Baccalaureate (IB) HL candidates who obtained at least a 4 in the required subjects, will be considered for admission.

Candidates who do not comply with the minimum admission requirements for BSc (Actuarial and Financial Mathematics), may be considered for admission to the BSc – Extended programme – Mathematical Sciences. This programme takes a year longer than the normal programmes to complete.

BSc – Extended programme – Mathematical Sciences				
Minimum requirements				
Achievement level				
English Home Language or English First Additional Language		**Mathematics**		**APS**
NSC/IEB	AS Level	NSC/IEB	AS Level	
4	D	5	C	**28**

Admissions from the BSc - Extended programmes to the BSc (Actuarial and Financial Mathematics) programmes

will only be considered if students have passed all their first-year modules with an average of at least 60%, passed IAS 111 and achieved a minimum percentage of 60% for WTW 143 and WTW 153.

Other programme-specific information

A student must pass all the minimum prescribed and elective module credits as set out at the end of each year within a programme as well as the total required credits to comply with the particular degree programme. Please refer to the curricula of the respective programmes. At least 144 credits must be obtained at 300-/400-level, or otherwise as indicated by curriculum. The minimum module credits needed to comply with degree requirements is set out at the end of each study programme. Subject to the programmes as indicated a maximum of 150 credits will be recognised at 100-level. A student may, in consultation with the relevant head of department and subject to the permission by the Dean, select or replace prescribed module credits not indicated in BSc three-year study programmes to the equivalent of a maximum of 36 module credits.

It is important that the total number of prescribed module credits is completed during the course of the study programme. The Dean may, on the recommendation of the relevant head of department, approve deviations in this regard. Subject to the programmes as indicated in the respective curricula, a student may not register for more than 75 module credits per semester at first-year level subject to permission by the Dean. A student may be permitted to register for up to 80 module credits in a the first semester during the first year provided that he or she obtained a final mark of no less than 70% for grade 12 Mathematics and achieved an APS of 34 or more in the NSC.

Students who are already in possession of a bachelor's degree, will not receive credit for modules of which the content overlap with modules from the degree that was already conferred. Credits will not be considered for more than half the credits passed previously for an uncompleted degree. No credits at the final-year or 300- and 400-level will be granted.

The Dean may, on the recommendation of the programme manager, approve deviations with regard to the composition of the study programme.

Please note: Where elective modules are not specified, these may be chosen from any modules appearing in the list of modules.

It remains the student's responsibility to acertain, prior to registration, whether they comply with the prerequisites of the modules they want to register for.

The prerequisites are listed in the Alphabetical list of modules.

Promotion to next study year

A student will be promoted to the following year of study if he or she passed 100 credits of the prescribed credits for a year of study, unless the Dean on the recommendation of the relevant head of department decides otherwise. A student who does not comply with the requirements for promotion to the following year of study, retains the credit for the modules already passed and may be admitted by the Dean, on recommendation of the relevant head of department, to modules of the following year of study to a maximum of 48 credits, provided that it will fit in with both the lecture and examination timetable.

General promotion requirements in the faculty
All students whose academic progress is not acceptable can be suspended from further studies.

- A student who is excluded from further studies in terms of the stipulations of the abovementioned regulations, will be notified in writing by the Dean or Admissions Committee at the end of the relevant semester.
- A student who has been excluded from further studies may apply in writing to the Admissions Committee of the Faculty of Natural and Agricultural Sciences for re-admission.
- Should the student be re-admitted by the Admissions Committee, strict conditions will be set which the student must comply with in order to proceed with his/her studies.
- Should the student not be re-admitted to further studies by the Admissions Committee, he/she will be informed in writing.
- Students who are not re-admitted by the Admissions Committee have the right to appeal to the Senate Appeals Committee.
- Any decision taken by the Senate Appeals Committee is final.

Pass with distinction

A student obtains his or her degree with distinction if all prescribed modules at 300-level (or higher) are passed in one academic year with a weighted average of at least 75%, and obtain at least a subminimum of 65% in each of the relevant modules.

Curriculum: Year 1

Minimum credits: 140

Fundamental = 12
Core = 132

Additional information:
Students who do not qualify for AIM 102 must register for AIM 111 and AIM 121.

Fundamental modules

Academic information management 102 (AIM 102)

Module credits	6.00
Service modules	Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities Faculty of Law Faculty of Health Sciences Faculty of Natural and Agricultural Sciences Faculty of Theology and Religion Faculty of Veterinary Science
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Information Science
Period of presentation	Semester 2

Module content

Find, evaluate, process, manage and present information resources for academic purposes using appropriate technology. Apply effective search strategies in different technological environments. Demonstrate the ethical and fair use of information resources. Integrate 21st-century communications into the management of academic information.

Academic information management 111 (AIM 111)

Module credits	4.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities Faculty of Law Faculty of Health Sciences Faculty of Natural and Agricultural Sciences Faculty of Theology and Religion
Prerequisites	No prerequisites.

Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Information Science
Period of presentation	Semester 1

Module content

Find, evaluate, process, manage and present information resources for academic purposes using appropriate technology.

Academic information management 121 (AIM 121)

Module credits	4.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities Faculty of Law Faculty of Health Sciences Faculty of Natural and Agricultural Sciences Faculty of Theology and Religion Faculty of Veterinary Science
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Informatics
Period of presentation	Semester 2

Module content

Apply effective search strategies in different technological environments. Demonstrate the ethical and fair use of information resources. Integrate 21st-century communications into the management of academic information.

Language and study skills 110 (LST 110)

Module credits	6.00
Service modules	Faculty of Natural and Agricultural Sciences Faculty of Veterinary Science
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Unit for Academic Literacy
Period of presentation	Semester 1

Module content
The module aims to equip students with the ability to cope with the reading and writing demands of scientific disciplines.

Academic orientation 102 (UPO 102)

Module credits	0.00
Language of tuition	Module is presented in English
Department	Natural and Agricultural Sciences Deans Office
Period of presentation	Year

Core modules

Economics 110 (EKN 110)

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
Prerequisites	No prerequisites.
Contact time	1 discussion class per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Economics
Period of presentation	Semester 1

Module content
This module deals with the core principles of economics. A distinction between macroeconomics and microeconomics is made. A discussion of the market system and circular flow of goods, services and money is followed by a section dealing with microeconomic principles, including demand and supply analysis, consumer behaviour and utility maximisation, production and the costs thereof, and the different market models and firm behaviour. Labour market institutions and issues, wage determination, as well as income inequality and poverty are also addressed. A section of money, banking, interest rates and monetary policy concludes the course.

Economics 120 (EKN 120)

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
Prerequisites	EKN 110 GS or EKN 113 GS and at least 4 (50-59%) in Mathematics in the Grade 12 examination or 60% in STK 113 and concurrently registered for STK 123
Contact time	1 discussion class per week, 2 lectures per week

Language of tuition	Module is presented in English
Department	Economics
Period of presentation	Semester 2

Module content

This module deals with the core principles of economics, especially macroeconomic measurement the private and public sectors of the South African economy receive attention, while basic macroeconomic relationships and the measurement of domestic output and national income are discussed. Aggregate demand and supply analysis stands core to this course which is also used to introduce students to the analysis of economic growth, unemployment and inflation. The microeconomics of government is addressed in a separate section, followed by a section on international economics, focusing on international trade, exchange rates and the balance of payments. The economics of developing countries and South Africa in the global economy conclude the course.

Financial management 112 (FBS 112)

Module credits	10.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	At least 6 (70-79%) in Mathematics in the Grade 12 examination or WTW 133 (60%), WTW 143 (60%), WST 133 (60%) and WST 143 (60%).
Contact time	3 lectures per week
Language of tuition	Module is presented in English
Department	Financial Management
Period of presentation	Semester 1

Module content

*Only for students in BSc (Actuarial and Financial Mathematics), BSc (Mathematics), BSc (Applied Mathematics), BSc (Mathematical Statistics), BSc Extended programme – Mathematical Sciences and BCom (Statistics) who comply with the set prerequisites.

Key principles of financial management. Company ownership. Taxation. Introduction to financial statements. Structure of financial statements. Depreciation and reserves. Preparing financial statements. Group financial statements and insurance company financial statements. Interpretation of financial statements. Limitation of financial statements. Issue of share capital.

Financial management 122 (FBS 122)

Module credits	10.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	FBS 112 or WST 121 and 07130261 or 07130262 or 02133388 or 02133273 or 02133395 or 02133274 or 02130007 or 02130016
Contact time	3 lectures per week
Language of tuition	Module is presented in English
Department	Financial Management

Period of presentation	Semester 2

Module content

Financial instruments. Use of financial derivatives. Financial institutions. Time value of money. Component cost of capital. Weighted average cost of capital. Capital structure and dividend policy. Capital project appraisal. Evaluating risky investments.

Actuarial and Financial Mathematics in practice 111 (IAS 111)

Module credits	6.00
Prerequisites	At least 6 (70-79%) in Mathematics and a APS score of 32 in the Grade 12 examination or WTW 133 (60%), WTW 143 (60%), WST 133 (60%) and WST 143 (60%).
Contact time	1 lecture per week, 1 practical per week
Language of tuition	Module is presented in English
Department	Actuarial Science
Period of presentation	Semester 1

Module content

Professionalism, working in multicultural environments, self-development, propositional logic, financial needs.

Actuarial and Financial Mathematics in practice 121 (IAS 121)

Module credits	6.00
Prerequisites	WTW 114 or WTW 153, WST 111 or WST 153, IAS 111.
Contact time	1 lecture per week, 1 practical per week
Language of tuition	Module is presented in English
Department	Actuarial Science
Period of presentation	Semester 2

Module content

Financial service providers, investment examples including an introduction to mathematics of finance, life insurance examples including an introduction to contingencies, general insurance examples including an introduction to reserving using run-off triangles, personal self-development.

Mathematical statistics 111 (WST 111)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	At least 5 (60-69%) in Mathematics in the Grade 12 examination
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Module is presented in English

Department	Statistics
Period of presentation	Semester 1

Module content

Characterisation of a set of measurements: Graphical and numerical methods. Random sampling. Probability theory. Discrete and continuous random variables. Probability distributions. Generating functions and moments.

Mathematical statistics 121 (WST 121)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 111 GS or WST 133, 143 and 153
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 2

Module content

Sampling distributions and the central limit theorem. Statistical inference: Point and interval estimation. Hypothesis testing with applications in one and two-sample cases. Introductory methods for: Linear regression and correlation, analysis of variance, categorical data analysis and non-parametric statistics. Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.

Calculus 114 (WTW 114)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities
Prerequisites	60% for Mathematics in Grade 12
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

*This module serves as preparation for students majoring in Mathematics (including all students who intend to enrol for WTW 218 and WTW 220). Students will not be credited for more than one of the following modules for their degree: WTW 114, WTW 158, WTW 134, WTW 165.
Functions, limits and continuity. Differential calculus of single variable functions, rate of change, graph sketching, applications. The mean value theorem, the rule of L'Hospital. Definite and indefinite integrals, evaluating definite integrals using anti-derivatives, the substitution rule.

Numerical analysis 123 (WTW 123)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 114
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Non-linear equations, numerical integration, initial value problems for differential equations, systems of linear equations. Algorithms for elementary numerical techniques are derived and implemented in computer programmes. Error estimates and convergence results are treated.

Mathematics 124 (WTW 124)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 114
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

*Students will not be credited for more than one of the following modules for their degree:
WTW 124, WTW 146, WTW 148 and WTW 164. This module serves as preparation for students majoring in Mathematics (including all students who intend to enrol for WTW 218, WTW 211 and WTW 220).

The vector space Rn, vector algebra with applications to lines and planes, matrix algebra, systems of linear equations, determinants. Complex numbers and factorisation of polynomials. Integration techniques and applications of integration. The formal definition of a limit. The fundamental theorem of Calculus and applications. Vector functions and quadratic curves.

Mathematical modelling 152 (WTW 152)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	50% for Mathematics in Grade 12
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

The module serves as an introduction to computer programming as used in science. Modelling of dynamical processes using difference equations; curve fitting and linear programming are studied. Applications are drawn from real-life situations in, among others, finance, economics and ecology.

Curriculum: Year 2

Minimum credits: 144

Core = 132
Elective = 12

Additional information:

- The elective must be chosen between IAS 282 or WTW 221.
- Students who want to follow an Actuarial career, should select IAS 282. Students who want to pursue an honours degree in Mathematics, should select WTW 221.

Core modules

Financial mathematics 211 (IAS 211)

Module credits	12.00
Service modules	Faculty of Economic and Management Sciences
Prerequisites	IAS 111, IAS 121, WTW 114, WTW 123, WTW 124, WTW 152, WST 111, WST 121
Contact time	1 practical per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Actuarial Science
Period of presentation	Semester 1

Module content

Principles of actuarial modelling, cash-flow models, the time value of money, interest rates, discounting and accumulating, level annuities, deferred and increasing annuities, equations of value.

Contingencies 221 (IAS 221)

Module credits	12.00
Prerequisites	IAS 211
Contact time	1 practical per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Actuarial Science
Period of presentation	Semester 2

Module content

Fundamentals of survival models, select and ultimate life tables, Assurance and annuity functions, basic calculation of premiums and reserves, principles of pricing and reserving.

Mathematical statistics 211 (WST 211)

Module credits	24.00

Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 111, WST 121, WTW 114 GS and WTW 124 GS
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1

Module content

Set theory. Probability measure functions. Random variables. Distribution functions. Probability mass functions. Density functions. Expected values. Moments. Moment generating functions. Special probability distributions: Bernoulli, binomial, hypergeometric, geometric, negative binomial, Poisson, Poisson process, discrete uniform, uniform, gamma,exponential, Weibull, Pareto, normal. Joint distributions: Multinomial, extended hypergeometric, joint continuous distributions. Marginal distributions. Independent random variables. Conditional distributions. Covariance, correlation. Conditional expected values. Transformation of random variables: Convolution formula. Order statistics. Stochastic convergence: Convergence in distribution. Central limit theorem. Practical applications. Practical statistical modelling and analysis using statistical computer packages and the interpretation of the output.

Applications in data science 212 (WST 212)

Module credits	12.00
Prerequisites	WST 111, WST 121 or STK 110, STC 122
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1

Module content

Introductory machine learning concepts. Data base design and use. Data preparation and extraction. Statistical modelling using data base structures. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.

Mathematical statistics 221 (WST 221)

Module credits	24.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211 GS
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Statistics

Period of presentation	Semester 2

Module content

Stochastic convergence: Asymptotic normal distributions, convergence in probability. Statistics and sampling distributions: Chi-squared distribution. Distribution of the sample mean and sample variance for random samples from a normal population. T-distribution. F-distribution. Beta distribution. Point estimation: Method of moments. Maximum likelihood estimation. Unbiased estimators. Uniform minimum variance unbiased estimators. Cramer-Rao inequality. Efficiency. Consistency. Asymptotic relative efficiency.
Bayes estimators. Sufficient statistics. Completeness. The exponential class. Confidence intervals. Test of statistical hypotheses. Reliability and survival distributions. Practical applications. Practical statistical modelling and analysis using statistical computer packages and the interpretation of the output.

Linear algebra 211 (WTW 211)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 124
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

This is an introduction to linear algebra on Rn. Matrices and linear equations, linear combinations and spans, linear independence, subspaces, basis and dimension, eigenvalues, eigenvectors, similarity and diagonalisation of matrices, linear transformations.

Calculus 218 (WTW 218)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 114 and WTW 124
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Calculus of multivariable functions, directional derivatives. Extrema and Lagrange multipliers. Multiple integrals, polar, cylindrical and spherical coordinates.

Analysis 220 (WTW 220)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 114 and WTW 124, WTW 211 and WTW 218
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

*This module is recommended as an elective only for students who intend to enrol for WTW 310 and/or WTW 320. Students will not be credited for more than one of the following modules for their degree: WTW 220 and WTW 224.

Properties of real numbers. Analysis of sequences and series of real numbers. Power series and theorems of convergence. The Bolzano-Weierstrass theorem. The intermediate value theorem and analysis of real-valued functions on an interval. The Riemann integral: Existence and properties of the interval.

Differential equations 264 (WTW 264)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	WTW 114 and WTW 124
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

*Students will not be credited for both WTW 162 and WTW 264 or both WTW 264 and WTW 286 for their degree.

Theory and solution methods for ordinary differential equations and initial value problems: separable and linear first order equations, linear equations of higher order, systems of linear equations. Laplace transform.

Elective modules

Financial mathematics 282 (IAS 282)

Module credits	12.00
Service modules	Faculty of Economic and Management Sciences

Prerequisites	IAS 211
Contact time	1 practical per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Actuarial Science
Period of presentation	Semester 2

Module content

Principles of actuarial modelling, cash-flow models, the time value of money, interest rates, discounting and accumulating, level annuities, deferred and increasing annuities, equations of value, loan schedules, project appraisal, elementary compound interest problems, term structure of interest rates.

Linear algebra 221 (WTW 221)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 211 and WTW 218
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Abstract vector spaces, change of basis, matrix representation of linear transformations, orthogonality, diagonalisability of symmetric matrices, some applications.

Curriculum: Final year

Minimum credits: 144

Core = 108
Elective = 36

There are two options for electives. Students should select electives according to one of the options.
1. Actuarial Science option: IAS 353, IAS 382
Students who want to try to obtain the maximum possible exemptions from the Actuarial Society examinations, and who meet the prerequisites, should select the Actuarial Science option.

2. Financial Mathematics option: WTW 310, and one of the following modules WTW 320, WTW 382

Students who want to complete the BSc (Actuarial and Financial Mathematics) degree, but are considering an honours degree in Mathematics, should in addition to the Financial Mathematics option take the module WTW 381 for non-degree purposes.

Students who want to complete the BSc (Actuarial and Financial Mathematics) degree, but are considering an honours degree in Applied Mathematics, should take the Financial Mathematics option with any two of the modules WTW 382, WTW 383, WTW386, with one of them for non-degree purposes.

Students who want to complete the BSc (Actuarial and Financial Mathematics) degree, but are considering an honours degree in Mathematical Statistics, should take in addition to either option STK 353 for non-degree purposes.

Students who would like to continue with any of the alternative above-mentioned honours degrees without taking additional credits can switch to the respective undergraduate programme during their third year. Students should note that they still qualify for exemptions from the Actuarial Society subjects if they switch to one of the alternative degrees.

Core modules

Multivariate analysis 311 (WST 311)

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211, WST 221, WTW 211 GS and WTW 218 GS
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1

Module content

Multivariate statistical distributions: Moments of a distribution, moment generating functions, independence. Multivariate normal distribution: Conditional distributions, partial and multiple correlations. Distribution of quadratic forms in normal variables. Multivariate normal samples: Estimation of the mean vector and covariance matrix, estimation of correlation coefficients, distribution of the sample mean, sample covariance matrix. Principal component analysis.The linear model: Models of full rank, least squares estimators, test of hypotheses.The generalised linear model: Exponential family mean and variance, link functions, deviance and residual analysis, test statistics, log- linear and logit models. Practical applications: Practical statistical modelling and analysis using statistical computer packages and interpretation of the output.

Stochastic processes 312 (WST 312)

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211, WST 221, WTW 211 GS and WTW 218 GS
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1

Module content

Definition of a stochastic process. Stationarity. Covariance stationary. Markov property. Random walk. Brownian motion. Markov chains. Chapman-Kolmogorov equations. Recurrent and transient states. First passage time. Occupation times. Markov jump processes. Poisson process. Birth and death processes. Structures of processes. Structure of the time-homogeneous Markov jump process. Applications in insurance. Practical statistical modelling, analysis and simulation using statistical computer packages and the interpretation of the output.

Time-series analysis 321 (WST 321)

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211, WST 221, WTW 211 GS and WTW 218 GS
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 2

Module content

Note: Only one of the modules WST 321 or STK 320 may be included in any study programme.

Stationary and non-stationary univariate time-series. Properties of autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) processes. Identification, estimation and diagnostic testing of a time-series model. Forecasting. Multivariate time-series. Practical statistical modelling and analysis using statistical computer packages, including that of social responsibility phenomena.

Actuarial statistics 322 (WST 322)

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211, WST 221, WTW 211 GS and WTW 218 GS
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 2

Module content

Bayes estimation. Loss distributions. Reinsurance. Risk models. Ruin theory. Credibility theory. Extreme value theory. Copulas. Practical statistical modelling and analysis using statistical computer packages.

Financial engineering 354 (WTW 354)

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	WST 211, WTW 211 and WTW 218
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Mean variance portfolio theory. Market equilibrium models such as the capital asset pricing model. Factor models and arbitrage pricing theory. Measures of investment risk. Efficient market hypothesis. Stochastic models of security prices

Financial engineering 364 (WTW 364)

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences
Prerequisites	WST 211, WTW 124, WTW 218 and WTW 286/264

Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Discrete time financial models: Arbitrage and hedging; the binomial model. Continuous time financial models: The Black-Scholes formula; pricing of options and the other derivatives; interest rate models; numerical procedures.

Elective modules

Contingencies 353 (IAS 353)

Module credits	18.00
Prerequisites	IAS 382, WST 312
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Actuarial Science
Period of presentation	Semester 2

Module content

Annuities and assurances involving one or two lives, life tables, Calculating premiums and reserves allowing for fixed or variable benefits and premiums, competing risks, profit testing.

Survival models 382 (IAS 382)

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences
Prerequisites	IAS 221 60%, IAS 282 60%, WST 211, WST 221, WTW 211, WTW 218
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Actuarial Science
Period of presentation	Semester 1

Module content

Survival models and the life table, estimating the lifetime distribution, proportional hazard models, the binomial and Poisson models, exposed to risk, graduation and statistical tests, methods of graduation.

Analysis 310 (WTW 310)

Module credits	18.00

Service modules	Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities
Prerequisites	WTW 220
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Topology of finite dimensional spaces: Open and closed sets, compactness, connectedness and completeness. Theorems of Bolzano-Weierstrass and Heine-Borel. Properties of continuous functions and applications. Integration theory for functions of one real variable. Sequences of functions.

Complex analysis 320 (WTW 320)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	WTW 218 and WTW 220
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Series of functions, power series and Taylor series. Complex functions, Cauchy- Riemann equations, Cauchy's theorem and integral formulas. Laurent series, residue theorem and calculation of real integrals using residues.

Dynamical systems 382 (WTW 382)

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 218 and WTW 286/264
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Matrix exponential function: homogeneous and non-homogeneous linear systems of differential equations. Qualitative analysis of systems: phase portraits, stability, linearisation, energy method and Liapunov's method. Introduction to chaotic systems. Application to real life problems.

Numerical analysis 383 (WTW 383)

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Humanities
Prerequisites	WTW 114, WTW 123 WTW 124 and WTW 211
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Direct methods for the numerical solution of systems of linear equations, pivoting strategies. Iterative methods for solving systems of linear equations and eigenvalue problems. Iterative methods for solving systems of nonlinear equations. Introduction to optimization. Algorithms for the considered numerical methods are derived and implemented in computer programmes. Complexity of computation is investigated. Error estimates and convergence results are proved.

Partial differential equations 386 (WTW 386)

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	WTW 248 and WTW 286/264
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Conservation laws and modelling. Fourier analysis. Heat equation, wave equation and Laplace's equation. Solution methods including Fourier series. Energy and other qualitative methods.

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.