University of Pretoria Yearbook 2016

BSc Extended programme - Mathematical Sciences (02130007)

Duration of study	4 years
Total credits	503

Admission requirements

- In order to register NSC/IEB/Cambridge candidates must comply with the minimum requirements for degree studies as well as the minimum requirements for the relevant study programme.
- Life Orientation is excluded in the calculation of the Admission Point Score (APS).
- Grade 11 results are used for the provisional admission of prospective students.
- Final admission is based on the Grade 12 results.

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Minimum requirements for 2016								
Achievement level								
Afrikaans or English				**Mathematics**				**APS**
NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	
4	3	D	D	5	3	C	C	26

NBT compulsory

BSc (Actuarial and Financial Mathematics): Admissions from the BSc (Four-year Programme) to the BSc (Actuarial and Financial Mathematics) study programme will only be considered if students have passed all their first-year modules with an average percentage of at least 60% as well as a minimum percentage of 60% for WTW 143 and WTW 153.

Please note

Students admitted to the BSc (Four-year programme) will attend classes at the Mamelodi Campus during the first year. Accommodation is available close to the Mamelodi Campus at the Naledi Residence situated in the Savannah Estate. Students who successfully complete their first year will attend lectures on the Hatfield Campus from their second academic year onwards.

Additional requirements

a. Students who are admitted to one of the BSc four-year programmes register for one specific programme. Three extended programmes are available:

- BSc (Four-year programme) – Mathematical Sciences
- BSc (Four-year programme) – Biological and Agricultural Sciences

- BSc (Four-year programme) – Physical Sciences

b. These programmes are followed by students who, as a result of exceptional circumstances, will benefit from an extended programme.
c. Students who do not comply with the normal three-year BSc entrance requirements for study in the Faculty of Natural and Agricultural Sciences, may nevertheless be admitted to the Faculty by being placed on the BSc (Four-year programme). Generally the BSc (Four-year programme) means that the first study year in Mathematics, Physics, Biology and Chemistry is extended to take two years. After completing the BSc (Four-year programme) successfully, students join the second year of the normal BSc programme to complete their degrees. The possibility of switching over to other faculties such as Engineering, Built Environment and Information Technology, Veterinary Science and Health Sciences, after one or two years in the four-year programme, exists. This depends on selection rules and other conditions stipulated by the other faculties.
d. Students who wish to follow one of the BSc four-year programmes will be subjected to an Institutional Proficiency Test and will be considered for admission by the Admissions Committee. Information in this regard is available at the Client Services Centre.
e. Applications for admission to the BSc (Four-year programme) should be submitted before 30 September each year. Details are obtainable from the Student Administration at the Faculty of Natural and Agricultural Sciences.
f. The rules and regulations applicable to the normal study programmes apply mutatis mutandis to the BSc (Four-year programme), with exceptions as indicated in the regulations pertaining to the BSc (Four-year programme). For instance, students placed in the BSc (Four-year programme) must have a National Senior Certificate with admission for degree purposes.
g. An admissions committee considers applications for the BSc (Four-year programme) annually. Regarding subject choices, admitted students are individually placed on the BSc (Four-year programme) according to their prospective field of study. Students may NOT change this placement without the permission of the Chairperson of the admissions committee.

Other programme-specific information

Students register for either one of the following elective combinations in the semester of the first year:

- PHY133 and CMY133 (prerequisite: Level 4 Grade 12 Physical Sciences)
- FRK133 and OBS133

In the second semester of the first year students register for the elective combination based on the combination chosen in the first semester:

- PHY143 and CMY143
- FRK143 and OBS143

With regard to the rest of the third-semester modules(second year, first semester) and the second-semester, prescribed modules must be selected from the normal BSc programme of the student’s choice.

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

Academic promotion requirements
It is expected of students who register for the first year of the BSc (Four-year programme) to pass all the prescribed modules of the first year.
It is expected of students accepted into the BSc (Four-year programme) to finish a complete corresponding BSc first year within the two years of enrolment in the BSc (Four-year programme). Students who do not show progress during the first semester of the first year will be referred to the Admissions Committee of the Faculty.

Curriculum: Year 1

Minimum credits: 88

Fundamental modules

Language, life and study skills 133 (LST 133)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	As for BSc Four-year programme and BCom Four-year programme
Contact time	4 discussion classes per week, Foundation Course, MAMELODI
Language of tuition	English
Academic organisation	Natural + Agric Sciences Dean
Period of presentation	Semester 1

Module content

In this module students use different information and time management strategies, build academic vocabulary, revise basic grammar concepts and dictionary skills, examine learning styles, memory and note-taking techniques, practise academic reading skills and explore basic research and referencing techniques, learn how to use discourse markers and construct definitions, and are introduced to paragraph writing. The work is set in the context of the students' field of study.

Language, life and study skills 143 (LST 143)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	LST 133
Contact time	Foundation Course, 4 discussion classes per week, MAMELODI
Language of tuition	English
Academic organisation	Natural + Agric Sciences Dean
Period of presentation	Semester 2

Module content

In this module students learn how to interpret and use visual literacy conventions. Students write more advance paragraphs, and also learn how to structure academic writing, how to refine their use of discourse markers and referencing techniques and how to structure their own academic arguments. Students' writing is expected to be rational, clear and concise. As a final assignment all aspects of the LST 133 and LST 143 modules are combined in a research assignment. In this project, students work in writing teams to produce a chapter on a career and to present an oral presentation of aspects of the chapter. The work is set in the context of the students' field of study.

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
Prerequisites	No prerequisites.
Contact time	MAMELODI, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	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 Faculty of Veterinary Science
Prerequisites	No prerequisites.
Contact time	2 lectures per week, MAMELODI
Language of tuition	Both Afr and Eng
Academic organisation	Information Science
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.

Academic orientation 120 (UPO 120)

Module credits	0.00

Language of tuition	Double Medium
Academic organisation	Humanities Dean's Office
Period of presentation	Year

Core modules

Precalculus 133 (WTW 133)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Health Sciences
Prerequisites	BSc and BCom students: At least 3 (40-49%) in Mathematics in the Grade 12 examination and must be taken concurrently with WTW133
Contact time	3 lectures per week, Foundation Course, MAMELODI, 1 practical per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Real numbers, elementary set notation, exponents and radicals. Algebraic expressions, fractional expressions, linear and quadratic equations, inequalities. Coordinate geometry: lines, circles. Functions: definition, notation, piecewise defined functions, domain and range, graphs, transformations of functions, symmetry, even and odd functions, combining functions, one-to-one functions and inverses, polynomial functions and zeros. Sequences, summation notation, arithmetic, geometric sequences, infinite geometric series, annuities and instalments. Degrees and radians, unit circle, trigonometric functions, fundamental identities, trigonometric graphs, trigonometric identities, double-angle, half-angle formulae, trigonometric equations, applications.

This module is only offered in English at the Mamelodi Campus for the BSc Extended programme. At the Hatfield and Groenkloof campuses it is offered in English and Afrikaans.

Calculus 143 (WTW 143)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Health Sciences
Prerequisites	BSc and BCom students: WTW 133 and WST133 and must be taken concurrently with WTW143
Contact time	Foundation Course, MAMELODI, 1 tutorial per week, 3 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths

Period of presentation	Semester 2

Module content

Functions: exponential and logarithmic functions, natural exponential and logarithmic functions, exponential and logarithmic laws, exponential and logarithmic equations, compound interest. Limits: concept of a limit, finding limits numerically and graphically, finding limits algebraically, limit laws without proofs, squeeze theorem without proof, one-sided limits, infinite limits, limits at infinity, vertical, horizontal and slant asymptotes, substitution rule, continuity, laws for continuity without proofs. Differentiation: average and instantaneous change, definition of derivative, differentiation rules without proofs, derivatives of polynomials, chain rule for differentiation, derivatives of trigonometric, exponential and logarithmic functions, applications of differentiation: extreme values, critical numbers, monotone functions, first derivative test, optimisation.

Mathematical statistics 133 (WST 133)

Module credits	8.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	At least 4 (50-59%) in Mathematics in the Grade 12 examination; BSc and BCom numeric stream students must be take WTW 133 concurrently.
Contact time	4 lectures per week, 2 tutorials per week, MAMELODI, Foundation Course, 1 practical per week
Language of tuition	English
Academic organisation	Statistics
Period of presentation	Semester 1

Module content

Descriptive statistics – Univariate:
The role of Statistics, various types of data. Sampling, probability and non-probability sampling techniques and the collection of data. Frequency, relative and cumulative distributions and graphical representations. Additional concepts relating to data processing: sigma notation, factorial notation. Descriptive measures of location,dispersion and symmetry. Exploratory data analysis.
Probability:
Introductory probability theory and applications. Set theory and probability laws. Introduction to random variables. Assigning probabilities, probability distributions, expected value and variance in general. Specific discrete probability distributions (Uniform, Binomial). Report writing and presentation. Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.

Mathematical statistics 143 (WST 143)

Module credits	8.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	BSc and BCom numeric students: WST 133 and WTW 133 and must be taken concurrently with WTW 143.
Contact time	1 practical per week, Foundation Course, 4 lectures per week, MAMELODI, 2 tutorials per week

Language of tuition	English
Academic organisation	Statistics
Period of presentation	Semester 2

Module content

Probability and inference:
Probability theory and theoretical distributions for continuous random variables (Uniform, Normal and t). Sampling distributions (means and proportions). Estimation theory and hypothesis testing of sampling averages and proportions (one- and two-sample cases).
Optimisation techniques with economic applications:
Applications of differentiation in statistic and economic related problems. Integration. Applications of integration in statistic and economic related problems. Systems of equations in equilibrium. The area under a curve and applications of definite integrals in Statistics and Economics. Report writing and presentation. Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.

Elective modules

Chemistry 133 (CMY 133)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	As for BSc Four-year programme
Contact time	Fortnightly practicals, Foundation Course, 3 discussion classes per week, 2 lectures per week, MAMELODI
Language of tuition	Both Afr and Eng
Academic organisation	Chemistry
Period of presentation	Semester 1

Module content

The field of Chemistry – an overview; Mathematics in Chemistry; atomic theory: historical overview; atoms, molecules and ions; relative atomic mass; electronic structure of atoms; the periodic table; periodicity; chemical bonding.

Chemistry 143 (CMY 143)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	CMY 133
Contact time	2 lectures per week, MAMELODI, 3 discussion classes per week, Foundation Course, Fortnightly practicals
Language of tuition	Both Afr and Eng

Academic organisation	Chemistry
Period of presentation	Semester 1

Module content

Bonding and molecular geometry: VSEPR theory; bonding and organic compounds (structural formulas, classification and nomenclature); matter and its properties; mole concept; reaction stoichiometry; reactions in aqueous solutions: precipitation, acid base and redox.

Physics 133 (PHY 133)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	As for BSc Four-year programme
Contact time	MAMELODI, 2 practicals per week, 2 lectures per week, Foundation Course, 2 discussion classes per week
Language of tuition	English
Academic organisation	Physics
Period of presentation	Semester 1

Module content

Heat: temperature and scales, the kinetic molecular model, work, energy and heat, calorimetry, specific heat, expansion, heat transfer. Measurements: SI-units, measuring error and uncertainty, (graphs), significant figures, mathematical modelling. Geometrical optics: reflection, refraction, dispersion, mirrors, thin lenses, instruments.

Physics 143 (PHY 143)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	PHY 133
Contact time	2 practicals per week, Foundation Course, 2 discussion classes per week, 2 lectures per week, MAMELODI
Language of tuition	English
Academic organisation	Physics
Period of presentation	Semester 2

Module content

Vectors. Kinematics of a point: relative motion, projectile, circular motion. Dynamics: Newton’s laws, friction. Work: point masses, ideal gas law, springs, power. Energy: kinetic energy, potential energy, conservative forces, spring, conservation of mechanical energy. Hydrostatics and dynamics: density, pressure, Archimedes' law, continuity, Bernouli.

Financial accounting 133 (FRK 133)

Module credits	8.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Only available to the BCom Four-year programme
Contact time	MAMELODI, 4 lectures per week, Foundation Course
Language of tuition	English
Academic organisation	Accounting
Period of presentation	Semester 1

Module content

The nature and function of accounting; the development of accounting; financial position; financial performance; flow of documents; the recording process; processing of accounting data; treatment of VAT; elementary statement of comprehensive income (income statement) and statement of financial position (balance sheet).

Financial accounting 143 (FRK 143)

Module credits	8.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	FRK 133; Only available to the BCom Four-year programme
Contact time	4 lectures per week, Foundation Course, MAMELODI
Language of tuition	English
Academic organisation	Accounting
Period of presentation	Semester 2

Module content

Accounting systems; introduction to internal control and internal control measures; bank reconciliations; control accounts; adjustments; preparing the financial statements of a sole proprietorship; the accounting framework.

Business management 133 (OBS 133)

Module credits	8.00
Prerequisites	Only available to BCom (Four-year programme) students
Contact time	Foundation Course, 3 lectures per week, 1 discussion class per week
Language of tuition	English
Academic organisation	Business Management
Period of presentation	Semester 1

Module content

Introduction to Business Management as a science, the environment in which the enterprise operates, the field of business, the mission and goals of an enterprise, management and entrepreneurship. The choice of a form of enterprise, the choice of products and/or services, profit and cost planning for different sizes of operating units, the choice of location, the nature of production processes and the layout of the plant or operating unit.

Business management 143 (OBS 143)

Module credits	8.00
Prerequisites	OBS 133; Only available to BCom (Four-year programme) students
Contact time	Foundation Course, 3 lectures per week, 1 discussion class per week
Language of tuition	English
Academic organisation	Business Management
Period of presentation	Semester 2

Module content

Introduction to and overview of general management, especially regarding the five management tasks, strategic management, contemporary developments and management issues, financial management, marketing, public relations. (Note: For marketing students, marketing is replaced by financial management, and public relations by small business management.)
Introduction to and overview of the value chain model, management of the input,
management of the purchasing function, management of the transformation process with specific reference to production and operations management, human resources management, and information management; corporate governance and black economic empowerment (BEE).

Curriculum: Year 2

Minimum credits: 28

Core modules

Calculus 153 (WTW 153)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	WTW 143
Contact time	Foundation Course, 1 tutorial per week, 3 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Differential calculus of a single variable with proofs and applications. The mean value theorem, the rule of L'Hospital. Upper and lower sums, definite and indefinite integrals, the Fundamental theorem of Calculus, the mean value theorem for integrals, integration techniques, with some proofs.

Mathematical statistics 153 (WST 153)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 133 and WST143 and WTW 143. Must be taken concurrently with WTW 153.
Contact time	1 practical per week, 4 lectures per week, Foundation Course, 2 tutorials per week
Language of tuition	English
Academic organisation	Statistics
Period of presentation	Semester 1

Module content

Probability distributions:
Introductory distribution theory and special statistical distributions (Binomial, Geometric, Hypergeometric, Poisson, Uniform, Normal, Gamma). Generating functions and moments. Bivariate probability distributions. Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.

Elective modules

Chemistry 154 (CMY 154)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	CMY 133 and CMY 143
Contact time	3 lectures per week, 2 tutorials per week, fortnightly practicals, Foundation Course
Language of tuition	English
Academic organisation	Chemistry
Period of presentation	Semester 1

Module content

Principles of reactivity: energy and chemical reactions. Physical behaviour of gasses, liquids, solids and solutions and the role of intermolecular forces. Rate of reactions: Introduction to Chemical kinetics. Introduction to chemical equilibrium. Introduction to organic chemistry: hybridisation, isomers (structural, geometrical and conformational), additions reactions and reaction mechanisms.

Program design: Introduction 110 (COS 110)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	COS 153 or COS 131 or COS 132 and Maths level 5 or WTW 133
Contact time	1 tutorial per week, 1 practical per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Computer Science
Period of presentation	Semester 2

Module content

The focus is on object-oriented (OO) programming. Concepts including inheritance and multiple inheritance, polymorphism, operator overloading, memory management (static and dynamic binding), interfaces, encapsulation, reuse, etc. will be covered in the module. The module teaches sound program design with the emphasis on modular code, leading to well structured, robust and documented programs. A modern OO programming language is used as the vehicle to develop these skills. The module will introduce the student to basic data structures, lists, stacks and queues.

Economics 113 (EKN 113)

Module credits	15.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Reg. 1.2 (e)
Contact time	3 lectures per week
Language of tuition	Both Afr and Eng

Academic organisation	Economics
Period of presentation	Semester 1

Module content

Introduction to economics and principles of microeconomics
The scope of economics; the basic theory of demand and supply; price, income and cross elasticity of demand; consumer utility, the utility function and case studies in terms of the utility function; the theory of the firm in the short and long run; market structures, namely the perfect market, monopoly, oligopoly and monopolistic competition; public sector finances; microeconomics versus macroeconomics and economic statistics.

Economics 123 (EKN 123)

Module credits	15.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Reg. 1.2 (e); EKN 113 GS
Contact time	3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Economics
Period of presentation	Semester 2

Module content

National income and principles of macroeconomics
The mechanics of national income accounts, the Keynesian macroeconomic model, the money market, demand for money and money supply, money and credit creation and the role of the monetary authorities. The IS-LM model of macroeconomic equilibrium and monetary and fiscal policy applications. The aggregate demand and supply models with the debate between the classical school, the monetarists and the Keynesian school. The problems of inflation and unemployment. Macroeconomic issues, namely macroeconomic policy, international trade, the balance of payments and economic growth.

Financial management 120 (FBS 120)

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences
Prerequisites	No prerequisites.
Contact time	3 lectures per week
Language of tuition	English
Academic organisation	Financial Management
Period of presentation	Semester 2

Module content

*Only for BSc (Mathematical Statistics, Construction Management, Real Estate and Quantity Surveying) students. Analysis of financial statements. Budgeting and budgetary control. Tax principles and normal income tax for individuals. Time value of money and its use for financial and investment decisions. Calculating the cost of capital and the financing of a business to maintain the optimal capital structure. Capital investment decisions and a study of the financial selection criteria in the evaluation of capital investment projects. The dividend decision and an overview of financial risk management.

Physics 153 (PHY 153)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	PHY 143
Contact time	2 practicals per week, Foundation Course, 2 discussion classes per week, 3 lectures per week
Language of tuition	English
Academic organisation	Physics
Period of presentation	Semester 1

Module content

System of particles: centre of mass, Newton's laws. Rotation: torque, conservation of momentum, impulse and collision, conservation of angular momentum, equilibrium, centre of gravity. Oscillations. Waves: sound, intensity, superposition, interference, standing waves, resonance, beats, Doppler effect. Physical optics: Young-interference, coherence, thin layers, diffraction, gratings, polarisation.

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	Both Afr and Eng
Academic organisation	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.

Discrete structures 115 (WTW 115)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 50% in the Grade 12 examination
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Propositional logic: truth tables, logical equivalence, implication, arguments. Mathematical induction and well-ordering principle. Introduction to set theory. Counting techniques: elementary probability, multiplication and addition rules, permutations and combinations, binomial theorem, inclusion-exclusion rule.

Numerical analysis 123 (WTW 123)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 114 GS
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
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.

Mathematical modelling 152 (WTW 152)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Refer to Regulation 1.2
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Introduction to the modelling of dynamical processes using difference equations. Curve fitting. Introduction to linear programming. Matlab programming. Applications to real-life situations in, among others, finance, economics and ecology.

Dynamical processes 162 (WTW 162)

Module credits	8.00
Prerequisites	WTW 114 GS
Contact time	2 lectures per week, 1 tutorial per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

*Students will not be credited for more than one of the following modules for their degree: WTW 162 and WTW 264.

Introduction to the modelling of dynamical processes using elementary differential equations. Solution methods for first order differential equations and analysis of properties of solutions (graphs). Applications to real life situations.

Financial management 112 (FBS 112)

Module credits	10.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	To be taken concurrently with WST 111
Contact time	3 lectures per week
Language of tuition	English
Academic organisation	Financial Management
Period of presentation	Semester 1

Module content

*Only for BSc (Actuarial and Financial Mathematics and Mathematical Statistics) and BCom (Statistics with option Mathematical Statistics) students.
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, to be taken concurrently with WST 121
Contact time	3 lectures per week
Language of tuition	English
Academic organisation	Financial Management
Period of presentation	Semester 2

Module content

*Only for BSc (Actuarial and Financial Mathematics; Mathematical Statistics) and BCom (Statistics with option Mathematical Statistics) students.

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.

Curriculum: Final year

Minimum credits: 28

Core modules

Calculus 153 (WTW 153)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	WTW 143
Contact time	Foundation Course, 1 tutorial per week, 3 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Differential calculus of a single variable with proofs and applications. The mean value theorem, the rule of L'Hospital. Upper and lower sums, definite and indefinite integrals, the Fundamental theorem of Calculus, the mean value theorem for integrals, integration techniques, with some proofs.

Mathematical statistics 153 (WST 153)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 133 and WST143 and WTW 143. Must be taken concurrently with WTW 153.
Contact time	1 practical per week, 4 lectures per week, Foundation Course, 2 tutorials per week
Language of tuition	English
Academic organisation	Statistics
Period of presentation	Semester 1

Module content

Probability distributions:
Introductory distribution theory and special statistical distributions (Binomial, Geometric, Hypergeometric, Poisson, Uniform, Normal, Gamma). Generating functions and moments. Bivariate probability distributions. Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.

Elective modules

Chemistry 154 (CMY 154)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	CMY 133 and CMY 143
Contact time	3 lectures per week, 2 tutorials per week, fortnightly practicals, Foundation Course
Language of tuition	English
Academic organisation	Chemistry
Period of presentation	Semester 1

Module content

Principles of reactivity: energy and chemical reactions. Physical behaviour of gasses, liquids, solids and solutions and the role of intermolecular forces. Rate of reactions: Introduction to Chemical kinetics. Introduction to chemical equilibrium. Introduction to organic chemistry: hybridisation, isomers (structural, geometrical and conformational), additions reactions and reaction mechanisms.

Program design: Introduction 110 (COS 110)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	COS 153 or COS 131 or COS 132 and Maths level 5 or WTW 133
Contact time	1 tutorial per week, 1 practical per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Computer Science
Period of presentation	Semester 2

Module content

The focus is on object-oriented (OO) programming. Concepts including inheritance and multiple inheritance, polymorphism, operator overloading, memory management (static and dynamic binding), interfaces, encapsulation, reuse, etc. will be covered in the module. The module teaches sound program design with the emphasis on modular code, leading to well structured, robust and documented programs. A modern OO programming language is used as the vehicle to develop these skills. The module will introduce the student to basic data structures, lists, stacks and queues.

Economics 113 (EKN 113)

Module credits	15.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Reg. 1.2 (e)
Contact time	3 lectures per week
Language of tuition	Both Afr and Eng

Academic organisation	Economics
Period of presentation	Semester 1

Module content

Introduction to economics and principles of microeconomics
The scope of economics; the basic theory of demand and supply; price, income and cross elasticity of demand; consumer utility, the utility function and case studies in terms of the utility function; the theory of the firm in the short and long run; market structures, namely the perfect market, monopoly, oligopoly and monopolistic competition; public sector finances; microeconomics versus macroeconomics and economic statistics.

Economics 123 (EKN 123)

Module credits	15.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Reg. 1.2 (e); EKN 113 GS
Contact time	3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Economics
Period of presentation	Semester 2

Module content

National income and principles of macroeconomics
The mechanics of national income accounts, the Keynesian macroeconomic model, the money market, demand for money and money supply, money and credit creation and the role of the monetary authorities. The IS-LM model of macroeconomic equilibrium and monetary and fiscal policy applications. The aggregate demand and supply models with the debate between the classical school, the monetarists and the Keynesian school. The problems of inflation and unemployment. Macroeconomic issues, namely macroeconomic policy, international trade, the balance of payments and economic growth.

Financial management 120 (FBS 120)

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences
Prerequisites	No prerequisites.
Contact time	3 lectures per week
Language of tuition	English
Academic organisation	Financial Management
Period of presentation	Semester 2

Module content

*Only for BSc (Mathematical Statistics, Construction Management, Real Estate and Quantity Surveying) students. Analysis of financial statements. Budgeting and budgetary control. Tax principles and normal income tax for individuals. Time value of money and its use for financial and investment decisions. Calculating the cost of capital and the financing of a business to maintain the optimal capital structure. Capital investment decisions and a study of the financial selection criteria in the evaluation of capital investment projects. The dividend decision and an overview of financial risk management.

Physics 153 (PHY 153)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	PHY 143
Contact time	2 practicals per week, Foundation Course, 2 discussion classes per week, 3 lectures per week
Language of tuition	English
Academic organisation	Physics
Period of presentation	Semester 1

Module content

System of particles: centre of mass, Newton's laws. Rotation: torque, conservation of momentum, impulse and collision, conservation of angular momentum, equilibrium, centre of gravity. Oscillations. Waves: sound, intensity, superposition, interference, standing waves, resonance, beats, Doppler effect. Physical optics: Young-interference, coherence, thin layers, diffraction, gratings, polarisation.

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	Both Afr and Eng
Academic organisation	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.

Discrete structures 115 (WTW 115)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 50% in the Grade 12 examination
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Propositional logic: truth tables, logical equivalence, implication, arguments. Mathematical induction and well-ordering principle. Introduction to set theory. Counting techniques: elementary probability, multiplication and addition rules, permutations and combinations, binomial theorem, inclusion-exclusion rule.

Numerical analysis 123 (WTW 123)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 114 GS
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
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.

Mathematical modelling 152 (WTW 152)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Refer to Regulation 1.2
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Introduction to the modelling of dynamical processes using difference equations. Curve fitting. Introduction to linear programming. Matlab programming. Applications to real-life situations in, among others, finance, economics and ecology.

Dynamical processes 162 (WTW 162)

Module credits	8.00
Prerequisites	WTW 114 GS
Contact time	2 lectures per week, 1 tutorial per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

*Students will not be credited for more than one of the following modules for their degree: WTW 162 and WTW 264.

Introduction to the modelling of dynamical processes using elementary differential equations. Solution methods for first order differential equations and analysis of properties of solutions (graphs). Applications to real life situations.

Financial management 112 (FBS 112)

Module credits	10.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	To be taken concurrently with WST 111
Contact time	3 lectures per week
Language of tuition	English
Academic organisation	Financial Management
Period of presentation	Semester 1

Module content

*Only for BSc (Actuarial and Financial Mathematics and Mathematical Statistics) and BCom (Statistics with option Mathematical Statistics) students.
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, to be taken concurrently with WST 121
Contact time	3 lectures per week
Language of tuition	English
Academic organisation	Financial Management
Period of presentation	Semester 2

Module content

*Only for BSc (Actuarial and Financial Mathematics; Mathematical Statistics) and BCom (Statistics with option Mathematical Statistics) students.

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.