BSc Mathematical Statistics (02133274)

Minimum duration of study 3 years
Total credits 428

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 provisional admission of prospective students. Final admission is based on the Grade 12 results.

<table>
<thead>
<tr>
<th>Achievement level</th>
<th>Afrikaans or English</th>
<th>Mathematics</th>
<th>APS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSC/IEB</td>
<td>HIGCSE</td>
<td>AS-Level</td>
</tr>
<tr>
<td>Minimum requirements</td>
<td>5</td>
<td>3</td>
<td>C</td>
</tr>
</tbody>
</table>

Candidates who do not comply with the minimum admission requirements for BSc (Mathematical Statistics), may be considered for admission to the BSc – Extended programme for Mathematical Sciences. The BSc – Extended programme takes place over a period of four years instead of the normal three years.

BSc - Extended programme for Mathematical Sciences:

<table>
<thead>
<tr>
<th>Achievement level</th>
<th>Afrikaans or English</th>
<th>Mathematics</th>
<th>APS</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>NSC/IEB</td>
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<td>AS-Level</td>
</tr>
<tr>
<td>BSc - Extended programme for Mathematical Sciences</td>
<td>4</td>
<td>3</td>
<td>D</td>
</tr>
</tbody>
</table>

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 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 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 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 ascertain, 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 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 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 Senior Appeals Committee.
- Any decision taken by the Senior 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

Minimum credits:
Fundamental =  12
Core = 64
Elective = 65

Additional information:
Students who do not qualify for AIM 102 must register for AIM 111 and AIM 121.
It is recommended that COS 132 be taken as a first-year elective by all students in this programme.

Additional electives should be chosen as follows:
Students in Mathematical Statistics who also want to be trained for the Mathematics industry normally choose from WTW 123 (8), 115 (8), 152 (8), 162 (8) and COS 110 (16)
Students in Mathematical Statistics who also want to be trained for the Insurance industry, Econometrics, normally choose:
EKN 113, 123 (30), FBS 110, 120 (20) or FBS 112, 122 (20) and COS 110 (16)
Students in Mathematical Statistics with other career requirements, choose modules from any other subject/faculty to meet their specific needs.

Fundamental modules

Academic information management 102 (AIM 102)

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.

Module credits 6.00

Service modules

<table>
<thead>
<tr>
<th>Faculty of Education</th>
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</thead>
<tbody>
<tr>
<td>Faculty of Economic and Management Sciences</td>
</tr>
<tr>
<td>Faculty of Humanities</td>
</tr>
<tr>
<td>Faculty of Law</td>
</tr>
<tr>
<td>Faculty of Health Sciences</td>
</tr>
<tr>
<td>Faculty of Natural and Agricultural Sciences</td>
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<tr>
<td>Faculty of Theology and Religion</td>
</tr>
<tr>
<td>Faculty of Veterinary Science</td>
</tr>
</tbody>
</table>

Prerequisites No prerequisites.

Contact time 2 lectures per week

Language of tuition Separate classes for Afrikaans and English
<table>
<thead>
<tr>
<th>Department</th>
<th>Information Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
</tr>
</tbody>
</table>

### Academic information management 111 (AIM 111)

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

**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** Separate classes for Afrikaans and English

<table>
<thead>
<tr>
<th>Department</th>
<th>Information Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
</tr>
</tbody>
</table>

### Academic information management 121 (AIM 121)

**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.

**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** Separate classes for Afrikaans and English
### Language and study skills 110 (LST 110)

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

<table>
<thead>
<tr>
<th>Module credits</th>
<th>6.00</th>
</tr>
</thead>
</table>

**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

### Academic orientation 102 (UPO 102)

**Module credits**
0.00

**Language of tuition**
Afrikaans and English are used in one class

**Department**
Natural and Agricultural Sciences Deans Office

**Period of presentation**
Year

### Core modules

### Mathematical statistics 111 (WST 111)

**Module content:**

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
</tr>
</thead>
</table>

**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
<table>
<thead>
<tr>
<th>Department</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
</tr>
</tbody>
</table>

**Mathematical statistics 121 (WST 121)**

**Module content:**

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
</tr>
</thead>
</table>
| 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 |

**Calculus 114 (WTW 114)**

**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.

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
</tr>
</thead>
</table>
| Service modules | Faculty of Engineering, Built Environment and Information Technology  
                  Faculty of Education  
                  Faculty of Economic and Management Sciences  
                  Faculty of Humanities |
| Prerequisites  | Refer to Regulation 1.2. Mathematics 60% Grade 12. |
| Contact time   | 1 tutorial per week, 4 lectures per week |
| Language of tuition | Separate classes for Afrikaans and English |
| Department     | Mathematics and Applied Mathematics |
| Period of presentation | Semester 1 |
**Mathematics 124 (WTW 124)**

**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 \( \mathbb{R}^n \), 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, polar curves and quadratic curves.

**Module credits**
16.00

**Prerequisites**
WTW 114

**Contact time**
1 tutorial per week, 4 lectures per week

**Language of tuition**
Separate classes for Afrikaans and English

**Department**
Mathematics and Applied Mathematics

**Period of presentation**
Semester 2

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**Elective modules**

**Program design: Introduction 110 (COS 110)**

**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.

**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**
COS 132 , COS 151 and Maths level 5

**Contact time**
1 practical per week, 1 tutorial per week, 3 lectures per week

**Language of tuition**
Separate classes for Afrikaans and English

**Department**
Computer Science

**Period of presentation**
Semester 2

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**Imperative programming 132 (COS 132)**

**Module content:**
This module introduces imperative computer programming, which is a fundamental building block of computer science. The process of constructing a program for solving a given problem, of editing it, compiling (both manually and automatically), running and debugging it, is covered from the beginning. The aim is to master the elements of a programming language and be able to put them together in order to construct programs using types, control structures, arrays, functions and libraries. An introduction to object orientation will be given. After completing this module, the student should understand the fundamental elements of a program, the importance of good program design and user-friendly interfaces. Students should be able to conduct basic program analysis and write complete elementary programs.

**Module credits**
16.00

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

**Prerequisites**
APS of 30 and level 5 (60-69%) Mathematics

**Contact time**
1 practical per week, 1 tutorial per week, 3 lectures per week

**Language of tuition**
Separate classes for Afrikaans and English

**Department**
Computer Science

**Period of presentation**
Semester 1

**Introduction to computer science 151 (COS 151)**

**Module content:**
This module introduces concepts and terminology related to the computer science discipline. General topics covered include the history of computing, machine level representation of data, Boolean logic and gates, basic computer systems organisation, algorithms and complexity and automata theory. The module also introduces some of the subdisciplines of computer science, such as computer networks, database systems, compilers, information security and intelligent systems. The module also focuses on modelling of algorithms.

**Module credits**
8.00

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

**Prerequisites**
APS of 30 and level 5 (60-69%) Mathematics.

**Contact time**
1 practical per week, 2 lectures per week

**Language of tuition**
Afrikaans and English are used in one class

**Department**
Computer Science

**Period of presentation**
Semester 1

**Economics 113 (EKN 113)**

**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.

<table>
<thead>
<tr>
<th>Module credits</th>
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</thead>
<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Natural and Agricultural Sciences</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>At least 6 (70-79%) in Mathematics or 60% in both Statistics 113 and 123.</td>
</tr>
<tr>
<td>Contact time</td>
<td>3 lectures per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>Module is presented in English</td>
</tr>
<tr>
<td>Department</td>
<td>Economics</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
</tr>
</tbody>
</table>

**Economics 123 (EKN 123)**

**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.

<table>
<thead>
<tr>
<th>Module credits</th>
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</thead>
<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Natural and Agricultural Sciences</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>At least 6 (70-79%) in Mathematics or 60% in both Statistics 113 and 123; EKN 113 GS</td>
</tr>
<tr>
<td>Contact time</td>
<td>3 lectures per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>Module is presented in English</td>
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<tr>
<td>Department</td>
<td>Economics</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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</tbody>
</table>

**Financial management 110 (FBS 110)**

**Module content:**
*Only for BSc (Mathematical Statistics, Construction Management, Real Estate and Quantity Surveying) and BEng (Industrial Engineering) students.
shares and debt instruments.

| 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 | Module is presented in English |
| Department | Financial Management |
| Period of presentation | Semester 1 |

**Financial management 112 (FBS 112)**

**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.*


| 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 |

**Financial management 120 (FBS 120)**

**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.
### Financial management 122 (FBS 122)

**Module content:**

<table>
<thead>
<tr>
<th>Module credits</th>
<th>10.00</th>
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<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Natural and Agricultural Sciences</td>
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<tr>
<td>Contact time</td>
<td>3 lectures per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>Module is presented in English</td>
</tr>
<tr>
<td>Department</td>
<td>Financial Management</td>
</tr>
<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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</table>

### Discrete structures 115 (WTW 115)

**Module content:**

<table>
<thead>
<tr>
<th>Module credits</th>
<th>8.00</th>
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</thead>
</table>
| 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 | Module is presented in English |
### Numerical analysis 123 (WTW 123)

**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.

<table>
<thead>
<tr>
<th>Module credits</th>
<th>8.00</th>
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</thead>
<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Engineering, Built Environment and Information Technology</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>WTW 114 GS</td>
</tr>
<tr>
<td>Contact time</td>
<td>1 tutorial per week, 2 lectures per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>Module is presented in English</td>
</tr>
<tr>
<td>Department</td>
<td>Mathematics and Applied Mathematics</td>
</tr>
<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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</tbody>
</table>

### Mathematical modelling 152 (WTW 152)

**Module content:**

<table>
<thead>
<tr>
<th>Module credits</th>
<th>8.00</th>
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<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Engineering, Built Environment and Information Technology</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Refer to Regulation 1.2</td>
</tr>
<tr>
<td>Contact time</td>
<td>1 tutorial per week, 2 lectures per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>Module is presented in English</td>
</tr>
<tr>
<td>Department</td>
<td>Mathematics and Applied Mathematics</td>
</tr>
<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
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</table>

### Dynamical processes 162 (WTW 162)

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

Module credits | 8.00
---|---
Prerequisites | WTW 114 GS
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
Curriculum: Year 2

Minimum credits: 144

Minimum credits:
Core = 96
Elective = 48

Additional information:
Students in Mathematical Statistics who also want to be trained for the Mathematics industry normally choose from WTW 264 (12) or WTW 286 (12), 285 (12).

Students in Mathematical Statistics who also want to be trained for the Insurance Industry normally choose IAS 221 (12), IAS 282 (12) (note the prerequisite specified by the Department of Insurance and Actuarial Science).

Students in Mathematical Statistics who also want to be trained for the Econometrics industry normally choose from: EKN 214(16), 224 (16) and STK 281 (10).

Students in Mathematical Statistics with other career requirements, choose modules from any other subject/faculty to meet their specific needs.

Core modules

Mathematical statistics 211 (WST 211)

Module content:

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
### Mathematical statistics 221 (WST 221)

**Module content:**

<table>
<thead>
<tr>
<th>Module credits</th>
<th>24.00</th>
</tr>
</thead>
</table>
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology  
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 |

### Linear algebra 211 (WTW 211)

**Module content:**
This is an introduction to linear algebra on $\mathbb{R}^n$. Matrices and linear equations, linear combinations and spans, linear independence, subspaces, basis and dimension, eigenvalues, eigenvectors, similarity and diagonalisation of matrices, linear transformations.

<table>
<thead>
<tr>
<th>Module credits</th>
<th>12.00</th>
</tr>
</thead>
</table>
| **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 |

### Calculus 218 (WTW 218)

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

**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

**Analysis 220 (WTW 220)**

**Module content:**

**Module credits** 12.00

**Service modules**
- 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

**Linear algebra 221 (WTW 221)**

**Module content:**
Abstract vector spaces, change of basis, matrix representation of linear transformations, orthogonality, diagnosability of symmetric matrices, some applications.

**Module credits** 12.00

**Service modules**
- 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
### Elective modules

#### Economics 214 (EKN 214)

**Module content:**

Macroeconomics

From Wall and Bay Street to Diagonal Street: a thorough understanding of the mechanisms and theories explaining the workings of the economy is essential. Macroeconomic insight is provided on the real market, the money market, two market equilibrium, monetarism, growth theory, cyclical analysis, inflation, Keynesian general equilibrium analysis and fiscal and monetary policy issues.

**Module credits**

16.00

**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 & EKN 120 OR EKN 113 GS & EKN 123; & STK 110 GS OR STK 113 & STK 123 & STK 120/121 or concurrently registered for STK 120/121 OR WST 111 & WST121 are prerequisites instead of STK 120/121 or WST 111 and concurrently registered for WST 121.

**Contact time**

3 lectures per week

**Language of tuition**

Separate classes for Afrikaans and English

**Department**

Economics

**Period of presentation**

Semester 1

#### Economics 224 (EKN 224)

**Module content:**

Microeconomics

Microeconomic insight is provided into: consumer and producer theory, general microeconomic equilibrium, Pareto-optimality and optimality of the price mechanism, welfare economics, market forms and the production structure of South Africa. Statistic and econometric analysis of microeconomic issues.

**Module credits**

16.00

**Service modules**

- Faculty of Education
- Faculty of Humanities
- Faculty of Natural and Agricultural Sciences
### Actuarial mathematics 211 (IAS 211)

**Module content:**
Accumulation functions, interest, time value of money, compounding periods, cash flow models, equations of value, annuities certain, continuous time application, loan schedules, performance measurement, valuation of fixed interest securities.

**Module credits**
12.00

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

**Prerequisites**
Pass WTW 114 and (WTW 126 and WTW 128 or (WTW 124) and WTW 123 and WST 111 and 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

### Actuarial mathematics 221 (IAS 221)

**Module content:**
Fundamentals of survival models, simple laws of mortality, derivation of contingent probabilities from life tables, contingent payments, expectation of life, elementary survival contracts, select and ultimate life tables, life annuities, accumulation and discounting, life insurance, net and gross premiums, reserves, statistical considerations.

**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
Financial mathematics 282 (IAS 282)

Module content:

<table>
<thead>
<tr>
<th>Module credits</th>
<th>12.00</th>
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<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Economic and Management Sciences</td>
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<tr>
<td>Prerequisites</td>
<td>IAS 211 60%</td>
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<tr>
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<td>Language of tuition</td>
<td>Module is presented in English</td>
</tr>
<tr>
<td>Department</td>
<td>Actuarial Science</td>
</tr>
<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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</table>

Informatics 214 (INF 214)

Module content:

<table>
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<tr>
<th>Module credits</th>
<th>14.00</th>
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<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>AIM 101 or AIM 111 and AIM 121</td>
</tr>
<tr>
<td>Contact time</td>
<td>2 lectures per week, 2 practicals per week</td>
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<td>Afrikaans and English are used in one class</td>
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<tr>
<td>Department</td>
<td>Informatics</td>
</tr>
<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
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</tbody>
</table>

Differential equations 264 (WTW 264)

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


| Module credits | 12.00 |
Service modules
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 2

Discrete structures 285 (WTW 285)

Module content:
Setting up and solving recurrence relations. Equivalence and partial order relations. Graphs: paths, cycles, trees, isomorphism. Graph algorithms: Kruskal, Prim, Fleury. Finite state automata.

Module credits
12.00

Service modules
Faculty of Engineering, Built Environment and Information Technology
Faculty of Education

Prerequisites
WTW 115

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

Differential equations 286 (WTW 286)

Module content:
*Students will not be credited for more than one of the modules for their degree: WTW 264, WTW 286

Module credits
12.00

Service modules
Faculty of Economic and Management Sciences

Prerequisites
WTW 114, WTW 124 and WTW 162

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
Curriculum: Final year

Minimum credits: 144

Minimum credits:
Core = 97
Elective = 47

Additional information:
Students in Mathematical Statistics who also want to be trained for the Mathematics industry normally choose from: WTW 310 (18), 320 (18), 354 (18), 364 (18), 381 (18), 382 (18), 383 (18), 385 (18), 386 (18), 387 (18), 389 (18).

Students in Mathematical Statistics who also want to be trained for the Insurance industry normally choose IAS 382 (20).

Students in Mathematical Statistics who also want to be trained for the Econometrics industry normally choose from: EKN 310, 320 and 314 (60).

Students in Mathematical Statistics with other career requirements, choose modules from any other subject/faculty to meet their specific needs.

Core modules

The science of data analytics 353 (STK 353)

Module content:
Sampling: basic techniques in probability, non-probability, and resampling methods. Designing experiments: experimental and control groups, different data types and relationships. Big and small data: exploring popular trends used in practice. Consultation practice: ethical considerations, study design, data collection and presentation, report writing and presentation. Hands-on application of statistical software and packages to real-life datasets.

Module credits 25.00

Service modules Faculty of Natural and Agricultural Sciences
Prerequisites STK 210, STK 220 or WST 211, WST 221
Contact time 1 practical per week, 3 lectures per week
Language of tuition Module is presented in English
Department Statistics
Period of presentation Semester 2

Multivariate analysis 311 (WST 311)

Module content:
Multivariate statistical distributions: Moments of a distribution, moment generating functions, independence. Multivariate normal distribution: Conditional distributions, partial and multiple correlations. Multinomial and

<table>
<thead>
<tr>
<th>Module credits</th>
<th>18.00</th>
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</table>
| 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 |

**Stochastic processes 312 (WST 312)**

**Module content:**

<table>
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<tr>
<th>Module credits</th>
<th>18.00</th>
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</thead>
</table>
| 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 |

**Time-series analysis 321 (WST 321)**

**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

**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

### Actuarial statistics 322 (WST 322)

**Module content:**

**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

### Elective modules

#### Economics 310 (EKN 310)

**Module content:**
Public finance

**Module credits** 20.00
Service modules
Faculty of Engineering, Built Environment and Information Technology
Faculty of Education
Faculty of Humanities
Faculty of Natural and Agricultural Sciences

Prerequisites
EKN 214, EKN 234 or EKN 224, EKN 244

Contact time
1 discussion class per week, 2 lectures per week

Language of tuition
Afrikaans and English are used in one class

Department
Economics

Period of presentation
Semester 1

**Economics 314 (EKN 314)**

**Module content:**
International trade/finance
International economic insight is provided into international economic relations and history, theory of international trade, international capital movements, international trade politics, economic and customs unions and other forms or regional cooperation and integration, international monetary relations, foreign exchange markets, exchange rate issues and the balance of payments, as well as open economy macroeconomic issues.

**Module credits**
20.00

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

**Prerequisites**
EKN 234, EKN 244

**Contact time**
3 lectures per week

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

**Department**
Economics

**Period of presentation**
Semester 1

**Economics 320 (EKN 320)**

**Module content:**
Economic analyses
Identification, collection and interpretation process of relevant economic data; the national accounts (i.e. income and production accounts, the national financial account, the balance of payments and input-output tables); economic growth; inflation; employment, unemployment, wages, productivity and income distribution; business cycles; financial indicators; fiscal indicators; social indicators; international comparisons; relationships between economic time series - regression analysis; long-term future studies and scenario analysis; overall assessment of the South African economy from 1994 onwards.

**Module credits**
20.00
### Service modules

| Faculty of Engineering, Built Environment and Information Technology |
| Faculty of Education |
| Faculty of Humanities |
| Faculty of Natural and Agricultural Sciences |

### Prerequisites

- EKN 310 GS

### Contact time

- 1 discussion class per week, 2 lectures per week

### Language of tuition

- Afrikaans and English are used in one class

### Department

- Economics

### Period of presentation

- Semester 2

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### Actuarial modelling 382 (IAS 382)

**Module content:**


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<th>Module credits</th>
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<td>Language of tuition</td>
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<td>Actuarial Science</td>
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<tr>
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### Analysis 310 (WTW 310)

**Module content:**


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<td>Contact time</td>
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<td>Language of tuition</td>
<td>Afrikaans and English are used in one class</td>
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<td>Department</td>
<td>Mathematics and Applied Mathematics</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
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**Complex analysis 320 (WTW 320)**

*Module content:*  

<table>
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<td>Faculty of Education</td>
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<tr>
<td>Prerequisites</td>
<td>WTW 218 and WTW 220</td>
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<tr>
<td>Contact time</td>
<td>1 tutorial per week, 2 lectures per week</td>
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<td>Language of tuition</td>
<td>Afrikaans and English are used in one class</td>
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<td>Department</td>
<td>Mathematics and Applied Mathematics</td>
</tr>
<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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</table>

**Financial engineering 354 (WTW 354)**

*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.

<table>
<thead>
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<tr>
<td>Service modules</td>
<td>Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences</td>
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<tr>
<td>Prerequisites</td>
<td>WST 211, WTW 211 and WTW 218</td>
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<tr>
<td>Contact time</td>
<td>1 tutorial per week, 2 lectures per week</td>
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<td>Language of tuition</td>
<td>Afrikaans and English are used in one class</td>
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<td>Mathematics and Applied Mathematics</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
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</table>

**Financial engineering 364 (WTW 364)**

*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.
**Algebra 381 (WTW 381)**

**Module content:**
Group theory: Definition, examples, elementary properties, subgroups, permutation groups, isomorphism, order, cyclic groups, homomorphisms, factor groups. Ring theory: Definition, examples, elementary properties, ideals, homomorphisms, factor rings, polynomial rings, factorisation of polynomials. Field extensions, applications to straight-edge and compass constructions.

**Module credits** 18.00

**Service modules**
- Faculty of Education
- Faculty of Economic and Management Sciences
- Faculty of Humanities

**Prerequisites**
WTW 114 and WTW 211

**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

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**Dynamical systems 382 (WTW 382)**

**Module content:**

**Module credits** 18.00

**Service modules**
- 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

**Numerical analysis 383 (WTW 383)**

**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.

**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

**Partial differential equations 386 (WTW 386)**

**Module content:**  

**Module credits**  
18.00

**Service modules**  
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

**Continuum mechanics 387 (WTW 387)**

**Module content:**  
**Module credits** 18.00

**Service modules** 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 2

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**Geometry 389 (WTW 389)**

**Module content:**
Axiomatic development of neutral, Euclidean and hyperbolic geometry. Using models of geometries to show that the parallel postulate is independent of the other postulates of Euclid.

**Module credits** 18.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology
Faculty of Education
Faculty of Humanities

**Prerequisites** WTW 211

**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

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The information published here is subject to change and may be amended after the publication of this information. The General Regulations (G Regulations) apply to all faculties of the University of Pretoria. It is expected of each student to familiarise himself or herself 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.