University of Pretoria Yearbook 2016

MSc Mathematics (02250181)

Duration of study	1 year
Total credits	180

Programme information

The programme compilation consists of two master's coursework modules of 30 credits each (the choice of modules to be decided by the Head of Department in consultation with the postgraduate coordinator) as well as a dissertation (120 credits).

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: http://www.up.ac.za/maths/postgrad

The MSc degree is conferred on the grounds of a dissertation and such additional postgraduate coursework as may be prescribed.

Renewal of registration
As long as progress is satisfactory, renewal of the registration of a master's student will be accepted for the second year of the study. Registration for a third and subsequent years will only take place when the Student Administration of the Faculty receives a written motivation that is supported by the head of department and Postgraduate Studies Committee.

General
Candidates are required to familiarise themselves with the General Regulations regarding the maximum period of registration and the requirements on the submission of a draft article for publication.

Admission requirements

An appropriate BScHons degree with a minimum of 60% for all modules at honours level. In the selection procedure the candidate's complete undergraduate and honours academic record will be considered. In particular it is strongly recommended that the following modules be included on honours level: Measure and integration theory, Functional analysis, Topology and Algebra.

Admission is also subject to the availability of a suitable supervisor for the study.

Additional requirements

Other programme-specific information

The minimum duration for this degree is one year. Subject to other faculty regulations, a student for a master's degree must complete his or her studies within three years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (Also see the General Regulations.)

Promotion to next study year

The progress of all master's candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

Subject to exceptions approved by the dean, on recommendation of the head of department, and where applicable, a student may not enter for the master's examination in the same module more than twice.

Pass with distinction

The MSc degree is conferred with distinction to candidates who obtain a final average mark of at least 75% and a mark of at least 75% for the dissertation/mini-dissertation from each of the members of the examination panel. Where a member of the examination panel awards a mark of less than 75% for the dissertation/mini-dissertation, that member of the examination panel must offer, in writing, support for his/her decision, or indicate in writing that he/she supports the examination committee's decision to confer the degree with distinction.

Curriculum: Year 1

Core modules

Dissertation Mathematics 890 (WIS 890)

Module credits	120.00
Prerequisites	No prerequisites.
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Year

Elective modules

Sobolev spaces 880 (WTW 880)

Module credits	30.00
Prerequisites	Measure theory, Differential equations and Functional analysis on honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

*Consult with the Head of Department of Mathematics and Applied Mathematics about the availability of this master's course in a particular year.
Mathematics about the availability of this masters module in a particular year.The module focuses on the Hilbertion Sobolev spaces as well as to their applications to elliptic boundary value problems. Topics to be discussed include: Distributions; Sobolev spaces of positive and negative integer orders; Sobolev spaces of traces; Embeddings of Sobolev spaces; Boundary value problems.

Abstract analysis 881 (WTW 881)

Module credits	30.00
Prerequisites	Measure Theory and Functional Analysis on honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Capita selecta from the following: Duality theory. Weak and Weak* topologies. The Krein- Milman theorem. The Stone-Weierstrass theorem. Fixed point theorems. Banach Algebras and the Gelfand transform. C*-algebras and their representations. Semigroups of operators. Functional analysis applied to probability theory and stochastics.

Advanced measure theory 884 (WTW 884)

Module credits	30.00
Prerequisites	Measure Theory and Functional Analysis on honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Lebesgue integral in a general measure space: Basic properties, convergence theorems, convergence in measure. Lebesgue spaces: Completeness, approximation by continuous functions. Complex measures: Absolute continuity, Random-Nikodym Theorem, representation of bounded linear functionals on Lebesgue spaces, Riesz Representation Theorem for bounded linear functionals on the space of continuous functions on a locally convergent Hausdorff space where X is a locally compact Hausdorff space. Applications to probability.

Dynamical systems 887 (WTW 887)

Module credits	30.00
Prerequisites	Functional Analysis, Partial Differential Equations and Finite Element Method on honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Finite dimensional dynamical systems: Autonomous and non-autonomous systems of differential equations, dynamical systems, linear and nonlinear systems, existence and uniqueness of solutions, extension of solutions, maximal solution and maximal interval of existence, phase space and phase portrait. Stability theory for equilibria and periodic orbits using linear approximation, Liapunov's method and other energy methods and discrete dynamical systems (Poincarè map). Introduction to strange attractors. Application to mechanics and population models. Infinite dimensional dynamical systems: Semigroups, first and second order abstract differential equations, Sobolev spaces, finite dimensional approximation. Application to heat conduction and mechanical vibration. Examples of nonlinear systems.

Finite element analysis 863 (WTW 863)

Module credits	30.00
Prerequisites	Finite element method and Functional analysis at honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1 or Semester 2

Module content

*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Finite element interpolation theory. Finite element approximation of elliptic boundary value problems and eigenvalue problems. Finite element approximation of parabolic and hyperbolic initial value problems. Applications in a project.

Curriculum: Final year

Core modules

Dissertation Mathematics 890 (WIS 890)

Module credits	120.00
Prerequisites	No prerequisites.
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Year

Elective modules

Sobolev spaces 880 (WTW 880)

Module credits	30.00
Prerequisites	Measure theory, Differential equations and Functional analysis on honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

*Consult with the Head of Department of Mathematics and Applied Mathematics about the availability of this master's course in a particular year.
Mathematics about the availability of this masters module in a particular year.The module focuses on the Hilbertion Sobolev spaces as well as to their applications to elliptic boundary value problems. Topics to be discussed include: Distributions; Sobolev spaces of positive and negative integer orders; Sobolev spaces of traces; Embeddings of Sobolev spaces; Boundary value problems.

Abstract analysis 881 (WTW 881)

Module credits	30.00
Prerequisites	Measure Theory and Functional Analysis on honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Capita selecta from the following: Duality theory. Weak and Weak* topologies. The Krein- Milman theorem. The Stone-Weierstrass theorem. Fixed point theorems. Banach Algebras and the Gelfand transform. C*-algebras and their representations. Semigroups of operators. Functional analysis applied to probability theory and stochastics.

Advanced measure theory 884 (WTW 884)

Module credits	30.00
Prerequisites	Measure Theory and Functional Analysis on honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Lebesgue integral in a general measure space: Basic properties, convergence theorems, convergence in measure. Lebesgue spaces: Completeness, approximation by continuous functions. Complex measures: Absolute continuity, Random-Nikodym Theorem, representation of bounded linear functionals on Lebesgue spaces, Riesz Representation Theorem for bounded linear functionals on the space of continuous functions on a locally convergent Hausdorff space where X is a locally compact Hausdorff space. Applications to probability.

Dynamical systems 887 (WTW 887)

Module credits	30.00
Prerequisites	Functional Analysis, Partial Differential Equations and Finite Element Method on honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Finite dimensional dynamical systems: Autonomous and non-autonomous systems of differential equations, dynamical systems, linear and nonlinear systems, existence and uniqueness of solutions, extension of solutions, maximal solution and maximal interval of existence, phase space and phase portrait. Stability theory for equilibria and periodic orbits using linear approximation, Liapunov's method and other energy methods and discrete dynamical systems (Poincarè map). Introduction to strange attractors. Application to mechanics and population models. Infinite dimensional dynamical systems: Semigroups, first and second order abstract differential equations, Sobolev spaces, finite dimensional approximation. Application to heat conduction and mechanical vibration. Examples of nonlinear systems.

Finite element analysis 863 (WTW 863)

Module credits	30.00
Prerequisites	Finite element method and Functional analysis at honours level
Contact time	1 lecture per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1 or Semester 2

Module content

*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Finite element interpolation theory. Finite element approximation of elliptic boundary value problems and eigenvalue problems. Finite element approximation of parabolic and hyperbolic initial value problems. Applications in a project.