Universiteit van Pretoria Jaarboek 2018

BScHons Wiskunde en Wiskundeonderwys Differensiaalvergelykings en Modellering (02240185)

Minimum duur van studie	1 jaar
Totale krediete	137

Programinligting

Hierdie inligting is slegs in Engels beskikbaar.

The programme consists of seven honours modules (five modules of 15 credits each from the Department of Mathematics and Applied Mathematics and two modules of 16 credits each from the Department of Science, Mathematics and Technology Education) as well as the compulsory research project (30 credits). Elective modules should be selected according to the prerequisites of these modules.
Candidates are required to familiarise themselves with the General Regulations regarding the maximum period of registration and other requirements for honours degrees.

Toelatingsvereistes

A BSc in Mathematics, Applied Mathematics or equivalent degree with at least a 60% average in the final year Mathematics or Applied Mathematics subjects. The final year should include at least four of the following third-year level modules or equivalent: partial differential equations, dynamical systems (ordinary differential equations), real analysis, complex analysis, numerical analysis and continuum mechanics. In the selection procedure the candidate's complete undergraduate academic record will be considered.

Bevordering tot volgende studiejaar

The progress of all honours candidates is monitored biannually by the postgraduate coordinator/head of department. 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.

Slaag met lof

The BScHons degree is awarded with distinction to a candidate who obtains a weighted average of at least 75% in all the prescribed modules and a minimum of 65% in any one module.

Kurrikulum: Finale jaar

Minimum krediete: 137

Fundamentele modules

Projek 795 (WTW 795)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Jaar

Module-inhoud

Raadpleeg Departement.

Kernmodules

Wiskunde- en wiskundegeletterheid onderwys 730 (MCE 730)

Modulekrediete	16.00
Diensmodules	Fakulteit Natuur- en Landbouwetenskappe
Voorvereistes	Geen voorvereistes.
Onderrigtaal	Module word in Engels aangebied
Departement	Wetenskap-, Wiskunde- en Tegnologie-onderwys
Aanbiedingstydperk	Semester 1 of Semester 2

Module-inhoud

Onderrig- en leerperspektiewe in wiskunde. Hierdie eenheid fokus op huidige kwessies in wiskunde-onderrig, byvoorbeeld: Aard van wiskundige kennis in die opvoedkunde; leerteorieë in wiskundeonderwys; gebruik van tegnologie in wiskunde-onderwys; navorsing in die klaskamer; geslag; taal; kultuur (Etno-wiskunde).
Wiskunde in konteks: vooruitsigte en uitdagings. Hierdie eenheid fokus op die rol van wiskunde in verskillende kontekste (beroep- en alledaagse situasies ingesluit): Aard van wiskunde – wiskunde as ‘n menslike aktiwiteit; rasionale vir die leer van wiskunde; die teorie van realistiese wiskunde-onderwys; inhouds- en konteksgedrewe aanslag in wiskunde; wiskundige geletterdheid; kennisoordrag: uitdagings – skoolwiskunde vs realiteit.

Opvoedkundige navorsingsmetodolgie 745 (NMQ 745)

Modulekrediete	16.00
Onderrigtaal	Aparte klasse vir Engels en Afrikaans
Departement	Wetenskap-, Wiskunde- en Tegnologie-onderwys
Aanbiedingstydperk	Semester 1

Module-inhoud
Die aard van onderwyskundige navorsing: navorsingskonteks, wetenskap, navorsings-etiek, waarheid, rasionaliteit, subjektiwiteit en objektiwiteit. Kwantitatiewe en kwalitatiewe navorsingsbenaderings, navorsingsontwerpe en data-insamelingstegnieke. Verskeidenheid benaderings in kwalitatiewe navorsing, insluitend: gevallestudies, historiese navorsing, etnografiese en aksienavorsing. Basiese konsepte en beginsels van kwantitatiewe navorsing. Statistiese tegnieke in die onderwysnavorsingsproses. Opnamemetodologie en vraelysontwerp. Klassifikasie en grafiese voorstelling van data. Beskrywende metings. Statistiese inferensie. Dataverwerkingsprosedures. Parametriese versus nieparametriese toetse. Enkele toetsstatistiek (bv. F-toetse, en T–toetse).

Numeriese analise 733 (WTW 733)

Modulekrediete	15.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 1

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

An analysis as well as an implementation (including computer programs) of methods are covered. Numerical linear algebra: Direct and iterative methods for linear systems and matrix eigenvalue problems: Iterative methods for nonlinear systems of equations. Finite difference method for partial differential equations: Linear elliptic, parabolic, hyperbolic and eigenvalue problems. Introduction to nonlinear problems. Numerical stability, error estimates and convergence are dealt with.

Main principles of analysis in application 735 (WTW 735)

Modulekrediete	15.00
Voorvereistes	Calculus at 2nd-year level (eg WTW 218) and one 3rd-year level module on analysis or applications of analysis (eg WTW 310, WTW 382, WTW 383 or WTW 386)
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 1

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

Study of main principles of analysis in the context of their applications to modelling, differential equations and numerical computation. Specific principles to be considered are those related to mathematical biology, continuum mechanics and mathematical physics as presented in the modules WTW 772, WTW 787 and WTW 776, respectively.

Wiskundige optimering 750 (WTW 750)

Modulekrediete	15.00
Voorvereistes	Meervariant-Calculus op 2de-jaarsvlak; Lineêre Algebra op 2de-jaarsvlak
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 1

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

Classical optimisation: Necessary and sufficient conditions for local minima. Equality constraints and Lagrange multipliers. Inequality constraints and the Kuhn-Tucker conditions. Application of saddle point theorems to the solutions of the dual problem. One-dimensional search techniques. Gradient methods for unconstrained optimisation. Quadratically terminating search algorithms. The conjugate gradient method. Fletcher-Reeves. Second order variable metric methods: DFP and BFCS. Boundary following and penalty function methods for constrained problems. Modern multiplier methods and sequential quadratic programming methods. Practical design optimisation project.

Parsiële differensiaalvergelykings van wiskundige fisika 776 (WTW 776)

Modulekrediete	15.00
Voorvereistes	WTW 710 of WTW 735
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

Field-theoretic and material models of mathematical physics. The Friedrichs-Sobolev spaces. Energy methods and Hilbert spaces, weak solutions – existence and uniqueness. Separation of variables, Laplace transform, eigenvalue problems and eigenfunction expansions. The regularity theorems for elliptic forms (without proofs) and their applications. Weak solutions for the heat/diffusion and related equations.

Keusemodules

Spesiale temas 727 (WTW 727)

Modulekrediete	15.00
Voorvereistes	WTW 710, WTW 731, WTW 734 en WTW 724.
Kontaktyd	1 lesing per week
Onderrigtaal	Module word in Engels aangebied

Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

A selection of special topics will be presented that reflects the expertise of researchers in the Department. The presentation of a specific topic is contingent on student numbers. Consult the website of the Department of Mathematics and Applied Mathematics for more details.

Maatteorie en waarskynlikheid 734 (WTW 734)

Modulekrediete	15.00
Voorvereistes	Reële analise op derdejaarvlak
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 1

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

Measure and integration theory: The Caratheodory extension procedure for measures defined on a ring, measurable functions, integration with respect to a measure on a σ-ring, in particular the Lebesgue integral, convergence theorems and Fubini's theorem.
Probability theory: Measure theoretic modelling, random variables, expectation values and independence, the Borel-Cantelli lemmas, the law of large numbers. L^1-theory, L^2-theory and the geometry of Hilbert space, Fourier series and the Fourier transform as an operator on L^2, applications of Fourier analysis to random walks, the central limit theorem.

Eindige-elementmetode 763 (WTW 763)

Modulekrediete	15.00
Voorvereistes	WTW 733 word ten sterkste aanbeveel
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

An analysis as well as an implementation (including computer programs) of methods is covered. Introduction to the theory of Sobolev spaces. Variational and weak formulation of elliptic, parabolic, hyperbolic and eigenvalue problems. Finite element approximation of problems in variational form, interpolation theory in Sobolev spaces, convergence and error estimates.

Stogastiese calculus 764 (WTW 764)

Modulekrediete	15.00
Voorvereistes	WTW 734 of WTW 735
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

Mathematical modelling of Random walk. Conditional expectation and Martingales. Brownian motion and other Lévy processes. Stochastic integration. Ito's Lemma. Stochastic differential equations. Application to finance.

Wiskundige metodes en modelle 772 (WTW 772)

Modulekrediete	15.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 1

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

This module aims at using advanced undergraduate mathematics and rigorously applying mathematical methods to concrete problems in various areas of natural science and engineering.
The module will be taught by several lecturers from UP, industry and public sector. The content of the module may vary from year to year and is determined by relevant focus areas within the Department. The list of areas from which topics to be covered will be selected, includes: Systems of differential equations; dynamical systems; discrete structures; Fourier analysis; methods of optimisation; numerical methods; mathematical models in biology, finance, physics, etc.

Kontinuummeganika 787 (WTW 787)

Modulekrediete	15.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	2 lesings per week
Onderrigtaal	Module word in Engels aangebied
Departement	Wiskunde en Toegepaste Wiskunde
Aanbiedingstydperk	Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

Analysis of spatial versus material description of motion. Conservation laws. Derivation of stress tensors. Analysis of finite strain and rate of deformation tensors. Stress and strain invariants. Energy. Linear and nonlinear constitutive equations. Applications to boundary value problems in elasticity and fluid mechanics.