

Universiteit van Pretoria Jaarboek 2018

BScHons Toegepaste Wetenskap Metallurgie (12243007)

Minimum duur van studie 1 jaar

Totale krediete 120

Programinligting

Die BScHons (Toegepaste Wetenskap)-graad word deur die volgende akademiese departemente toegeken:

- Bedryfs- en Sisteemingenieurswese
- Chemiese Ingenieurswese
- Materiaalkunde en Metallurgiese Ingenieurswese
- Meganiese en Lugvaartkundige Ingenieurswese
- Mynbou-ingenieurswese
- Siviele Ingenieurswese

Enige spesifieke module word aangebied op voorwaarde dat 'n sekere minimum getal studente daarvoor inskryf, soos bepaal deur die departementshoof en die Dekaan. Raadpleeg die betrokke departementshoof oor die samestelling van 'n sinvolle nagraadse studieprogram, asook oor die leerplanne van die modules. Raadpleeg ook die betrokke departementele nagraadse brosjures.

Toelatingsvereistes

'n Toepaslike baccalaureusgraad, 'n BTech-graad of gelykwaardige kwalifikasie.

Ander programspesifieke inligting

'n Beperkte aantal toepaslike modules uit ander departemente word toegelaat. Nie alle modules wat gelys is, word elke jaar aangebied nie. Raadpleeg asseblief die departementele nagraadse brosjure.

Kurrikulum: Finale jaar

Minimum krediete: 120

NLO 700 compulsory module / verpligte module

Kernmodules

Basiese fisiese metallurgie 701 (NFM 701)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

This module serves as a bridge into full post graduate studies in physical and mechanical metallurgy for students who do not have a formal first degree in these subjects. The following topics are covered in this module: phases in alloys, diffusion, solidification, the precipitation of second phases in alloys and the recrystallisation and grain growth of single phase alloys, aluminium and its alloys, copper and its alloys, nickel base alloys, the iron-carbon phase diagram, the heat treatment of steels, dislocations and the deformation of metals, engineering strength of metals and alloys, creep deformation, introduction to fracture mechanics and fatigue and failure analysis. This module will, therefore, enable the student to understand the fundamentals that govern alloy design, heat treatment, physical and mechanical properties and behaviour of materials during heat treatment and under stress and will enable the correct selection of alloys for a particular use, the prescription of heat treatments and further mechanical processing of these alloys to achieve the required metallurgical and mechanical properties.

Basiese ekstraksiemetallurgie 701 (NHM 701)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2



Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

This module covers the fundamental principles of hydrometallurgy and minerals processing. In the minerals processing part of the module, students are given perspective on the scope of and functions in mineral processing, different unit operations and processing options for different deposits. Themes are comminution, classification, concentration, and solid-liquid separation. In the hydrometallurgy portion the merits and limitations of hydrometallurgy when compared with other metallurgical processes (e.g. pyrometallurgy) are considered; and different feed materials for hydrometallurgical processes; different unit processes in hydrometallurgy; fundamental thermodynamic and kinetic concepts as used in leaching; different leach reactors and their applications; solution purification and metal recovery processes; selecting a suitable flowsheet for a given feed material to produce a final metal product are discussed.

Navorsingsprojek 700 (NLO 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

The refereed literature on a specific topic (normally related to subsequent research towards a master's degree) is studied and summarised in a written report. The important skills are finding appropriate papers, reading and comprehending these, and using the information in the paper to construct your own view on the research topic. There are no formal contact sessions. The first part of this module involves definition of a research topic (to be approved by the head of the department), development of a literature survey and compilation of a detailed research proposal. The second part of the module involves generation, presentation and critical interpretation of a project plan/results, and compilation of a written report and an oral presentation. The written survey document must be submitted at the end of October, with an oral presentation of 20-30 minutes in the week following submission of the survey.

Basiese pirometallurgie 701 (NPM 701)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2



Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

In this module you will develop the skills required to analyse the equilibria of pyrometallurgical processes. Solving such a problem requires skills in thermodynamic analysis, and knowledge of the typical processes (and the conditions within these processes) which are used to extract and refine metals like iron (steel), copper, titanium, chromium, manganese, and aluminium. The aim is to enable you to analyse a current or proposed process with regards to feasibility, and to propose processing conditions (e.g. temperature, slag composition) which will achieve the required equilibrium state. This also applies to refractory systems, where the primary aim will be to evaluate whether a given refractory material is suitable for a given application, or the impact of certain impurities on the refractory material.

Keusemodules

Elektrometallurgie 700 (NEL 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Jaar

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

At the end of the module, students should be able to conceptualise and design new electrometallurgical processes and improve the operation of existing processes through an understanding of the basic principles of the thermodynamics and kinetics of electrochemistry, measurement techniques used in electrochemistry, and considering the principles of electrochemical reactor design, different electrode and cell configurations, role of additives to electrolytes, role of impurities in the electrowinning process, the steps involved in electrocrystallization processes and present practices used for the electrowinning of metals such as copper, nickel, cobalt, zinc, manganese and gold.

Vervaardigingsingenieurswese 700 (NFE 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2



Module-inhoud

Hierdie module ondersoek kwaliteitsversekering en -beheer in sweisvervaardiging, en stel die student bekend aan verskeie standarde en vervaardigingskodes wat in die sweisbedryf gebruik word. Meting, beheer en vaslegging van data tydens sweising, die beginsel van geskiktheid-vir-diens, sowel as gesondheid en veiligheid word aangespreek. Beheer van resspannings en distorsie tydens sweising, nievernietigende toetsing, herstelweis en die ekonomiese aspekte van sweis word bespreek. Hierdie module ondersoek ook die uitleg van aanlegte en werkswinkels, die gebruik van setmate en inklemming. Spesiale klem word geplaas op die ontwerp en implementasie van sweisprosedures, die kwalifikasie van sweisprosedures en kwaliteits-beheerplanne. 'n Aantal gevallestudies word ondersoek.

Fisiese metaalkunde 700 (NFM 700)

Modulekrediete 30.00

Voorvereistes Geen voorvereistes.

Kontaktyd 48 kontakure per semester

Onderrigtaal Module word in Engels aangebied

Departement Materiaalkunde en Metallurgiese Ingenieurswese

Aanbiedingstydperk Semester 1 of Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

The module deals with the basic understanding of phase transformations in alloys, and its relationship with microstructure and mechanical properties of alloys. Included are transformation processes such as solidification; nucleation, growth and coarsening of precipitates; the use of carbides and intermetallic compounds in steels; static and dynamic re-crystallisation; grain growth and the use of grain boundary engineering; the martensite, bainite and pearlite transformations; thermomechanical processing and some elements of quantitative metallography. The course is practice orientated; the current best fundamental understanding of these transformation processes covered, and its role in engineering application demonstrated. The course is fully documented on CD-ROM from the latest literature and is largely intended for that research student who is embarking on a physical metallurgical research project.

Hittebehandeling 700 (NHB 700)

Modulekrediete 30.00

Voorvereistes Geen voorvereistes.

Kontaktyd 48 kontakure per semester

Onderrigtaal Module word in Engels aangebied

Departement Materiaalkunde en Metallurgiese Ingenieurswese

Aanbiedingstydperk Semester 1 of Semester 2

Module-inhoud

*Hierdie module word slegs in Engels aangebied.



Hidrometallurgie 700 (NHM 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

The aim with this course is to enable the students to understand the design and operation of hydrometallurgical processes for the beneficiation of minerals and metals. The theoretical basis of the solution chemistry underlying hydrometallurgical processes, the purification and concentration options available, and the metal recovery processes such as precipitation, hydrogen reduction, and electrowinning are reviewed. This is then followed by the consideration of the engineering aspects and the technical application of hydrometallurgical processes for a number of ores relevant to South Africa.

Korrosie 700 (NKR 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

The aim with this course is to facilitate the development of the students in corrosion engineering by considering the electrochemical fundamentals of corrosion processes as well as their experimental and practical implications for corrosion diagnosis and control. The practical manifestations of the broad types of corrosion are reviewed and the skills of the students to utilise corrosion control methodologies such as chemical and electrochemical control, protective coatings and material selection to control corrosion are developed.

Meganiese metallurgie 700 (NMM 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese



Aanbiedingstydperk	Semester 1 of Semester 2
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Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

We cover the interaction between the internal structure of metals – on the atomic and microscopic scales – and their mechanical properties. Practically important topics such as elastic and plastic stress analysis, dislocations and deformation, room and high temperature deformation processes, mechanical property/microstructure relationships for low and medium Carbon steels and for micro-alloyed and HSLA steels, fatigue processes, stress corrosion cracking, creep deformation processes and fracture mechanics are covered in depth, and illustrated with case studies. The course is largely available on CD-ROM with references to the latest literature.

Mineraalprosessering 700 (NMP 700)

Modulekrediete	30.00
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Voorvereistes	Geen voorvereistes.
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Kontaktyd	48 kontakure per semester
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Onderrigtaal	Module word in Engels aangebied
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Departement	Materiaalkunde en Metallurgiese Ingenieurswese
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Aanbiedingstydperk	Semester 1 of Semester 2
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Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

Principles and advanced theory of comminution, classification and density separation are covered.

Toegepaste monsternemingsteorie in mineraalprosessering 701 (NMP 701)

Modulekrediete	30.00
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Voorvereistes	Geen voorvereistes.
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Kontaktyd	48 kontakure per semester
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Onderrigtaal	Module word in Engels aangebied
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Departement	Materiaalkunde en Metallurgiese Ingenieurswese
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Aanbiedingstydperk	Semester 1 of Semester 2
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Module-inhoud

Die module spreek beide die teorie en toepassing van monsterneming aan, hoofsaaklik in die mineraalprosesseringsindustrie. Monsterneming is in beginsel statisties van aard en dus sal basiese statistiese metodes, relevant tot monsternemingsteorie behandel word. Die module sal dan fokus op die teorie van monsterneming, spesifiek ten opsigte van die bestuur van groot- en kleinskaalse veranderlikheid. In die gedeelte oor grootskaalse veranderlikheid, sal die effek van interpolasiefoute, periodiese foute en geweegde-inkrement foute ook aangespreek word. In die gedeelte wat handel oor kleinskaalse veranderlikheid, word die bepaling en bestuur van verskeie foute, wat lei tot kleinskaalse veranderlikheid hanteer – dit sluit in die saamstel van monsternemingsmetodes wat hierdie foute kan minimeer. Die evaluasie van droë- en nat monsternemingsapparaat, ten opsigte van verskillende bronne wat eensydigheid kan genereer, asook die implementering van monsternemingsmetodes in die praktyk word behandel. Steenkool-, yster-, goud- en platinumerts sal die fokus vorm van die module.

Pirometallurgie 700 (NPM 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

We aim to provide you with practice in using fundamental principles to analyse pyrometallurgical processes – to be able to go from understanding to process improvement. To this end, the necessary fundamentals of reaction equilibria (including activity descriptions), reaction kinetics, and mass and energy balances are reviewed. Practical examples illustrate the use of these principles. In the final block, we analyse a number of practical processes in more detail. Throughout, the emphasis is on quantification.

Skuimflottasie 700 (NSF 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2



Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

Fundamentals of sulphide and coal flotation are covered, including the chemistry of sulphide mineral flotation; natural and induced hydrophobicity; physical and chemical interactions in coal flotation; review of sulphydryl and oxydryl collectors and their absorption mechanisms; the role of activators/depressants and pH regulators as well as an investigation of frothers and froth stability, with reference to recent industrial developments. Aspects of flotation practice are addressed: Experimental methods for laboratory and plant trials; basic and complex flotation circuits with examples from recent developments; control in flotation plants: reagents/conditioning. Finally, relevant interfacial surface chemistry is covered: the role of water in flotation; mechanisms and thermodynamics of collector activity.

Sweismetallurgie 700 (NSW 700)

Modulekrediete 30.00

Voorvereistes Geen voorvereistes.

Kontaktyd 48 kontakure per semester

Onderrigtaal Module word in Engels aangebied

Departement Materiaalkunde en Metallurgiese Ingenieurswese

Aanbiedingstydperk Semester 1 of Semester 2

Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

This module examines the basic physical metallurgy and heat treatment of various metals and alloys, and the application of various mechanical testing techniques, microstructural analysis and corrosion testing to characterise metals and alloys. The structure and properties of welds in carbon steels, stainless steels, cast irons, copper and copper alloys, nickel and nickel alloys, aluminium and aluminium alloys and other materials (Ti, Mg, Ta and Zr) are discussed. Defects are discussed and various techniques to avoid the formation of these defects in welds are considered.

Vuurvaste materiale 700 (NVM 700)

Modulekrediete 30.00

Voorvereistes Geen voorvereistes.

Kontaktyd 48 kontakure per semester

Onderrigtaal Module word in Engels aangebied

Departement Materiaalkunde en Metallurgiese Ingenieurswese

Aanbiedingstydperk Semester 1 of Semester 2



Module-inhoud

*Hierdie inligting is slegs in Engels beskikbaar.

The objective is to convey a fundamental understanding of the principles that are involved in the manufacture, selection and use of refractories. Relevant thermodynamic principles are reviewed, with emphasis on the thermodynamic properties of oxide materials, metals and slags, and how these affect refractory performance. Phase diagram use in refractory selection and prediction of slag-metal-refractory interactions is covered. A section on manufacture covers the types of raw materials, design and formulation, handling, manufacturing routes, and quality control (including practical mineralogy). Finally, design properties of refractories for the ferrous, cement, aluminium, copper, platinum and ferro-alloy industries are reviewed.

Wiskundige modellering van metallurgiese prosesse en materiale 780 (NWM 780)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 Kontakure
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2

Module-inhoud

Hierdie module spreek beide die teorie en toepassing van wiskundige modellering aan spesifiek toegepas op metallurgiese prosesse en materiale. Die module is 'n toepassing van die teorie wat bemeester is tydens vorige studies van byvoorbeeld wiskunde, fisika, termodinamika, vloeimeganika, hitte-oordrag, ens. om wiskundige voorstellings van prosesse en materiale te skep. 'n Verskeidenheid modelleringstegnieke word aangespreek in die module, soos oplossings modelle van vaste en vloeistof oplossings, massa- en energiebalanse, gestadigde toestand prosesmodelle, dinamiese prosesmodelle, hitte-oordrag modelle, numeriese termovloei, multifisika modelle en tegniese-ekonomiese modelle. Die geskepte modelle word dan toegepas om navorsings- en industriële probleme op te los.

Sweisprosesse 700 (NWP 700)

Modulekrediete	30.00
Voorvereistes	Geen voorvereistes.
Kontaktyd	48 kontakure per semester
Onderrigtaal	Module word in Engels aangebied
Departement	Materiaalkunde en Metallurgiese Ingenieurswese
Aanbiedingstydperk	Semester 1 of Semester 2

Module-inhoud

Hierdie module ondersoek boogfisika, elektrotegniek soos van toepassing op sweiskragbronne, en sweiskragbrontwerp. Die basiese beginsels, toepassings, verbruikbares en prosesveranderlikes van verskeie boogswais-, gassweis-, weerstandswais-, stralingswais- en vaste toestandsweisprosesse word ondersoek. Soldering en hardsoldering, snytegnieke, oppervlakverandering en metaalsproeitegnieke word bespreek. Hierdie module fokus ook op die sweis van polimere, keramiese materiale en saamgestelde materiale, en op die meganisasie en aanwending van robotika in die sweisbedryf.

Sweisontwerp 701 (NWP 701)

Modulekrediete 30.00

Voorvereistes Geen voorvereistes.

Kontaktyd 48 kontakure per semester

Onderrigtaal Module word in Engels aangebied

Departement Materiaalkunde en Metallurgiese Ingenieurswese

Aanbiedingstydperk Semester 1 of Semester 2

Module-inhoud

Hierdie module ondersoek die ontwerp en voorbereiding van sweislasse, die beginsels van sweisontwerp en die rol van breukmeganika in sweisontwerp. Die gedrag van gesweisde strukture onderwerp aan verskillende vorme van belasting word bespreek, met spesiale fokus op die ontwerp van gesweisde strukture met oorwegend statiese belasting, sowel as die sweis van dinamies belaste strukture. Die ontwerp van gesweisde druktoerusting, aluminiumstrukture en die sweis van staalbewapening word ook bespreek.

Die inligting wat hier verskyn, is onderhewig aan verandering en kan na die publikasie van hierdie inligting gewysig word.. Die [Algemene Regulasies \(G Regulasies\)](#) is op alle fakulteite van die Universiteit van Pretoria van toepassing. Dit word vereis dat elke student volkome vertrouwd met hierdie regulasies sowel as met die inligting vervat in die [Algemene Reëls](#) sal wees. Onkunde betreffende hierdie regulasies en reëls sal nie as 'n verskoning by oortreding daarvan aangebied kan word nie.