

**DEPARTMENT OF LOGISTICS
UNIVERSITY OF STELLENBOSCH**

**POSTGRADUATE INFORMATION:
OPERATIONS RESEARCH
2025**

***AFDELING LOGISTIEK
UNIVERSITEIT VAN STELLENBOSCH
NAGRAADSE INLIGTING:
OPERASIONELE NAVORSING
2025***

Tel: 021 808 3911

E-mail: jacquin@sun.ac.za

<http://www.sun.ac.za/logistics>

OPERATIONS RESEARCH POSTGRADUATE MODULES

Anchor programmes:

BComHons (Operations Research)

Programme module

Code	Module	Credits	Module Name
55336	778	120	BComHons (Operations Research)

MCom (Operations Research)

Programme modules

Code	Module	Credits	Module Name
55336	899	180	MCom or MSc (Operations Research) – Coursework and Thesis option

MCom (Operations Research)

Programme module

Code	Module	Credits	Module Name
55336	879	180	MCom or MSc (Operations Research) – Full Thesis option

MODULES FOR 2025			
Module	Code	Lecturer	Credits

First semester

Advanced linear programming [OR, BDatSci] [Compulsory]	10906 712	Prof SE Visagie	15
Metaheuristics [OR, BDatSci]	12318 713	Prof SE Visagie	15
Game Theory [OR]	10931 743	Dr I Nieuwoudt	15
System Dynamics [OR, BDatSci]	40541 774	Dr L Venter	15
Capita Selecta – Applied Recommender Systems [OR]	64009 771	Dr S Oladejo	15

Second semester

Inventory Control [OR] [Compulsory]	10932 742	Dr I Nieuwoudt	15
Forecasting [OR]	10933 753	Prof JH Nel	15
Methods of Operations Research [OR, BDatSci]	11907 786	Mr K Marais	15
Pass Prerequisite: Introduction to forecasting or OR 3 is a pass prerequisite for Forecasting 10933 753	Research Seminar, first and second semester: Operations Research BComHons 11047 774 Operations Research BScHons 11047 774		35 35
	OR MCom	150 11243	884
		180 11243	828

OPERASIONELE NAVORSING NAGRAADSE MODULES

Anker programme:

HonsBCom (Operasionele Navorsing)

Program module

Kode	Module	Krediete	Modulenaam
55336	778	120	Honneurs-BCom (Operasionele Navorsing)

MCom (Operasionele Navorsing)

Program module

Kode	Module	Krediete	Modulenaam
55336	899	180	MCom of MSc (Operasionele Navorsing) – Doseer-entesisopsie

MCom (Operasionele Navorsing)

Program module

Kode	Module	Krediete	Modulenaam
55336	879	180	MCom of MSc (Operasionele Navorsing) – Voltesisopsie

MODULES VIR 2025			
Module	Kode	Dosent	Krediete
Eerste semester			
Gevorderde Lineêre Programmering [ON, BDatSci] [Verplig]	10906 712	Prof SE Visagie	15
Metaheuristieke [ON, BDatSci]	12318 713	Prof SE Visagie	15
Speleorie [ON]	10931 743	Dr I Nieuwoudt	15
Stelseldinamika [ON, BDatSci]	40541-774	Dr L Venter	15
Capita Selecta – Toegepaste Aanbevelingstelsels [OR]	64009-771	Dr S Oladejo	15
Tweede semester			
Voorraadbeheer [ON] [Verplig]	10932 742	Dr I Nieuwoudt	15
Vooruitskatting [ON]	10933 753	Prof JH Nel	15
Metodes in Operasionele Navorsing [ON, BDatSci]	11907 786	Mnr K Marais	15
Voorvereistes: Inleiding tot Vooruitskatting of ON 3 is 'n slaagvoorvereiste vir Vooruitskatting 10933 753	Navorsingswerkstuk eerste en tweede semester: Operasionele Navorsing HonsBCom 11047 774 Operasionele Navorsing HonsBSc 11047 774		35 35
	ON MCom 150 11243 884 (Die 150 krediete ON MCom program vereis modules van 30 krediete) 180 11243 828		

10906 712 ADVANCED LINEAR PROGRAMMING

Course objective

Linear Programming (LP) is widely used in Operations Research, often to solve complex optimisation problems with limited resources. Advanced LP techniques are studied in this module.

Course content

1. Revised simplex method (product form of the inverse), primal-dual algorithms
2. Primal and dual upper bounded algorithms
3. Column generation methods
4. Decomposition
5. Interior point methods

Remarks

1. This module is presented during the first semester.
2. Operations Research 244 is a pass prerequisite for this module.
3. The module counts 15 credits.
4. The module is available to residential students only.

10906 712 GEVORDERDE LINEÛRE PROGRAMMERING

Kursusdoelwit

Lineêre programmering (LP) is een van die belangrikste en mees gebruikte tegnieke in Operasionele Navorsing. Dit word onder andere gebruik in die optimering van komplekse situasies met beperkte hulpbronne. In hierdie module word gevorderde LP-oplossingstegnieke bestudeer.

Kursusinhoud

1. *Hersiene simpleksalgoritme (produkform van inverse), primaal-duale algoritmes*
2. *Primale en duale bogrens-algoritmes*
3. *Kolomgenerering*
4. *Dekomposisie*
5. *Inwendige punt-metodes*

Opmerkings

1. *Hierdie module word gedurende die eerste semester aangebied.*
2. *Operasionele Navorsing 244 is 'n slaagvoorvereiste vir hierdie module.*
3. *Die module tel 15 krediete.*
4. *Die module is slegs aan residensiële studente beskikbaar.*

12318 713 METAHEURISTICS

Course objective

Practical operations research problems are often computationally too complex to solve via classical solution methods. This module explores methods that can determine good and not necessarily the best solutions in these circumstances. This module has a practical problem-solving approach. The theory and solution techniques are discovered, handled and applied from the perspective of different problem formulations.

Course content

1. Tabu search
2. Evolutionary metaheuristics
3. Simulated annealing
4. Ant colony algorithms
5. Modern developments in metaheuristics

Remarks

1. Students who follow this module must be able to programme in Python.
2. The module counts 15 credits.
3. The module is available to residential students only.

12318 713 METAHEURISTIEKE

Kursusdoelwit

Praktiese operasionele navorsingsprobleme is dikwels te berekeningsintensief om bevredigend met behulp van eksakte metodes op te los. Hierdie module rus studente met metodes toe om in sulke gevalle na goeie in plaas van die beste oplossings te soek. Die module het 'n praktiese, probleemgedrewe benadering. Die teorie en oplossingstegnieke word dus vanuit verskillende probleemstellings ondersoek, behandel en toegepas.

Kursusinhoud

1. *Tabu-soektog*
2. *Evolusionêre metaheuristieke*
3. *Gesimuleerde tempering*
4. *Mierkolonie-algoritmes*
5. *Moderne tendense in metaheuristieke*

Opmerkings

1. *Studente wat hierdie module volg, moet kan programmeer in Python.*
 2. *Die module tel 15 krediete.*
 3. *Die module is slegs aan residensiële studente beskikbaar.*
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10931 743 GAME THEORY

Course objective

In many situations, a decision maker cannot decide independently. For example, in a typical business environment, different role-players are in conflict and they make instantaneous and independent decisions. The outcomes of these decisions are normally determined by the decisions made by all the parties. Game theory supplies techniques to the decision maker to take decisions in these circumstances that will optimise the outcomes of all role players collectively or individually. In this module, a student will learn to identify situations where Game theory may be used, how to model these situations mathematically and how to solve these models.

Course content

1. Introduction to Game theory
2. Normal, extensive and strategic forms of games
3. Matrix games and pure strategies
4. Mixed strategies
5. Non zero sum games
6. Square games
7. Repeated games
8. Nash equilibrium
9. *N*-person games
10. Core of a game
11. Characteristic form
12. Indexes of power

Remarks

1. This module is presented during the first semester.
2. Operations Research 344 is a pass prerequisite for this module.
3. The module counts 15 credits.
4. This module is only available to residential students.

10931 743 SPELETHEORIE

Kursusdoelwit

In baie situasies kan 'n besluitnemer nie sy besluit onafhanklik neem nie. Byvoorbeeld, in 'n tipiese besigheidsoopset is die verskillende rolspelers gewoonlik in konflik en neem hulle gelyktydig en onafhanklik besluite. Die uitkoms van so 'n situasie word beïnvloed deur elkeen van die betrokke rolspelers se besluite/keuses. Speletheorie verskaf tegnieke aan 'n besluitnemer om besluite in sulke situasies te neem wat die uitkoms vir die rolspelers, gesamentlik of individueel, wiskundig optimeer. In hierdie module leer 'n mens om situasies te herken waarin speletheorie gebruik kan word, om dit wiskundig te modelleer en om die modelle op te los.

Kursusinhoud

1. *Inleiding tot speletheorie*
2. *Normale, uitgebreide en strategiese vorms van spele*
3. *Matrikspele en suiwer strategieë*
4. *Gemengde Strategieë*
5. *Nie-nulsom spele*
6. *Vierkantpele*
7. *Herhaalde spele*
8. *Nash-ekwilibrium*
9. *N -persoonpele*
10. *Kern van 'n spel*
11. *Karakteristieke vorm*
12. *Magsindekse*

Opmerkings

1. *Hierdie module word in die eerste semester aangebied.*
2. *Operasionele Navorsing 344 is 'n slaagvoorvereiste vir hierdie module.*
3. *Die module tel 15 krediete.*
4. *Die module is slegs aan residensiële studente beskikbaar.*

10932 742 INVENTORY CONTROL

Course objective

There exists a fine balance between the cost involved in keeping inventory and the monetary loss in the case of a stock-out when inventory was needed. In this module the student is firstly introduced to the diverse factors involved when an optimal inventory strategy is developed. Secondly, the student is also introduced to various mathematical models used in a wide range of Inventory control situations.

10932 743 VOORRAADBEHEER

Kursusdoelwit

Daar bestaan 'n delikate balans tussen die koste verbonde aan die hou van voorraad en die geldelike verlies wat kan ontstaan in die geval van 'n voorraadtekort wanneer voorraad benodig word. In hierdie module word die student eerstens bekendgestel aan die uiteenlopende faktore wat 'n rol speel in die ontwikkeling van 'n optimale voorraadstrategie. Tweedens word die student ook aan verskeie wiskundige modelle bekendgestel wat in 'n wye reeks voorraadbeheersituasies gebruik word.

Course content

1. Factors involved in Inventory control
2. Revision of the basic EOQ model (deterministic as well as probabilistic)
3. Adaptations to the basic EOQ model in order to provide for quantity discounts, backloging, etc.
4. The news vendor problem
5. The service level approach
6. The ABC inventory classification system
7. The JIT approach
8. Multi-echelon inventory models
9. Inventory control for products subject to obsolescence
10. Inventory management of rentable items
11. Case studies

Remarks

1. This module is presented in the second semester.
2. This module counts 15 credits.
3. This module is available to residential students only.
4. Probability Theory and Statistics 114 or 144 is a pass prerequisite for this module.

Kursusinhoud

1. *Faktore wat voorraadbeheer beïnvloed*
2. *Hersiening van die basiese EKV-model (deterministies sowel as probabilisties)*
3. *Aanpassings aan die basiese EKV-model om kwantiteitsafslag, agterstande, ens. in ag te neem*
4. *Die nuusverkoperprobleem*
5. *Die diensvlakbenadering*
6. *Die ABC-voorraadklassifikasiesetel*
7. *Die JIT-benadering*
8. *Multivlakvoorraadmodelle*
9. *Voorraadbeheer vir produkte wat aan veroudering onderhewig is*
10. *Voorraadbestuur van verhuurbare items*
11. *Gevalllestudies*

Opmerkings

1. *Die module word gedurende die tweede semester aangebied.*
2. *Die module tel 15 krediete.*
3. *Die module is slegs aan residensiële studente beskikbaar.*
4. *Waarskynlikheidsleer en Statistiek 114 of 144 is 'n slaagvoorvereiste vir hierdie module.*

10933 753 FORECASTING

Course objective

In addition to the general problems in time series data considered in Module 11 (Introduction to forecasting), there are several more intricate problems related to time series data which require more intricate techniques for the identification and forecasting process. Students are familiarised with these techniques in order to identify and solve these problems.

Course content

The module comprises three sections:

Section I

Revision of

1. Basic inferential statistics
2. The linear regression model and the method of least squares
3. Diverging from basic assumptions
4. Dummy and lag variables
5. Test and evaluation criteria

Section II

Advanced forecasting techniques:

1. Stationarity of time series
2. Moving average and exponential smoothing models
3. Decomposition of time series
4. Functional forms in regression

10933 753 VOORUITSKATTING

Kursusdoelwit

Benewens die algemene probleme in tydreeksdata wat in Module 11 (Inleiding tot Vooruitskatting) gedek word, bestaan daar ook verskeie dieperliggende probleme met tydreeksdata wat meer gevorderde identifikasietegnieke vereis om gepaste optrede te neem in die ontledings- en vooruitskattingsproses. Tydens hierdie module sal studente tegnieke aanleer om hierdie probleme te identifiseer en op te los.

Kursusinhoud

Die module bestaan uit drie afdelings:

Deel I

Hersiening van:

1. *Basiese inferensiële statistiek*
2. *Lineêre regressiemodel en die metode van kleinste kwadrate*
3. *Afwykinge van basiese aannames*
4. *Skyn- en sloeringsveranderlikes*
5. *Toets- en evalueringskriteria*

Deel II

Gevorderde vooruitskattingstegnieke

1. *Stasionariteit van tydreeks*
2. *Bewegende gemiddeldes- en eksponensiële gladstrykingsmodelle*
3. *Dekomposisie van tydsreeks*
4. *Funksionele vorms van regressie*

5. Gompertz and Logistic curves
6. Logistic regression
7. ARIMA models
8. Short and long term models

Section III

Applications of Forecasting

1. Data gathering and related problems
2. Single and multivariate functions
3. Modelling (Excel and R)
4. Presenting and interpreting modelling results

Remarks

1. The module is presented during the second semester.
2. The module carries 15 credits.
3. Introduction to forecasting or Operations Research 3 is a pass prerequisite for this module.
4. This module is available to residential students only.

5. Gompertz en Logistiese kurwes
6. Logistiese regressie
7. ARIMA modelle
8. Kort- en langtermynmodelle

Deel III

Toepassings van vooruitskatting

1. Dataversameling en verwante probleme
2. Enkel- en meerveranderlike funksies
3. Modellerings (Excel en R)
4. Aanbieding en interpretasie van modelresultate

Opmerkings

1. Die module word gedurende die tweede semester aangebied.
2. Die module tel 15 krediete.
3. Inleiding tot Vooruitskatting of Operasionele Navorsing 3 is 'n slaagvoorvereiste vir hierdie module.
4. Die module is slegs aan residensiële studente beskikbaar.

11907 786 METHODS OF OPERATIONS RESEARCH

Course objective

This project-driven module is offered in collaboration with a number of partners in industry, who share the view that good operations researchers are bred through practical experience. The module is offered in the form of three project-driven cycles, in which site visits to industry, mathematical modelling and the oral as well as written reporting of results play an important role.

Course content

Project topics are typically taken from the fields of:

1. Mathematical programming;
2. Inventory control;
3. Data analysis;
4. Simulation;
5. Scheduling;
6. Forecasting.

Remarks

1. The module is presented during the second semester.
2. The module counts 15 credits.
3. Operations Research 3 is a pass prerequisite for this module.
4. This module is available to residential students only.
5. Computer programming skills are required.

11907 786 METODEDES IN OPERASIONELE NAVORSING

Kursusdoelwit

Hierdie projekgedrewe module word in samewerking met 'n aantal vennote in die industrie aangebied, wat die visie deel dat goeie operasionele navorsers deur praktiese ervaring gekweek word. Die module word in die vorm van drie projek-gedrewe siklusse aangebied, waarin praktiese veldbesoeke, wiskundige modellerings en die mondelinge sowel as geskrewe aanbieding van resultate 'n sentrale rol speel.

Kursusinhoud

Projekonderwerpe resorteer normaalweg onder die breër velde van:

1. Wiskundige programmering;
2. Voorraadbeheer;
3. Data-analise;
4. Simulasie;
5. Skedulering;
6. Vooruitskatting.

Opmerkings

1. Die module word gedurende die tweede semester aangebied.
2. Die module tel 15 krediete.
3. Operasionele Navorsing 3 is 'n slaagvoorvereiste vir hierdie module.
4. Die module is slegs aan residensiële studente beskikbaar.
5. Rekenaarprogrammeringsvaardighede word vereis.

40541 774 SYSTEM DYNAMICS

Course objective:

This module will introduce students to the simulation technique, System Dynamics. System Dynamics is 'n technique with which we can analyse the nonlinear behaviour of complex systems by using stocks, flows, and internal feedback loops. Upon completion of this module, students will have the ability to identify apt applications for SD simulation, understand the underlying theory, build executable models in the appropriate software, and interpret models.

Course content:

1. Introduction to systems thinking
2. Systems modelling
3. Modelling change
4. Positive feedback
5. Negative feedback
6. S-shaped growth and oscillation
7. Delays and smoothing
8. Building a system dynamics model
9. Model calibration
10. Validation and verification

Remarks

1. The module is presented during the first semester.
2. The module is for 15 credits
3. Operations Research 3 is a prerequisite for this module.
4. The module is presented residentially only.
5. Assessment for this module consists of weekly assignments and a phase approach project.

40541 774 STESELNAMIKA

Kursusdoelwit:

Hierdie module sal studente bekendstel aan die simulasietegniek, Stelseldinamika. Stelseldinamika is 'n tegniek waarmee ons die nie-lineêre gedrag van komplekse stelsels kan ontleed deur voorraad, vloei en interne terugvoerlusse te gebruik. Na voltooiing van hierdie module sal studente die vermoë hê om geskikte toepassings vir SD-simulasie te identifiseer, die onderliggende teorie te verstaan, uitvoerbare modelle in die toepaslike sagteware te bou en modelle te interpreteer.

Kursusinhoud:

1. Inleiding tot sisteemdenke
2. Stelselmodellering
3. Modelleringsverandering
4. Positiewe terugvoer
5. Negatiewe terugvoer
6. S-vormige groei en ossillasie
7. Verdragings en gladmaak
8. Bou 'n stelseldinamikamodel
9. Modelkalibrasie
10. Bekragtiging en verifikasie

Opmerkings

1. Die module word gedurende die eerste semester aangebied.
2. Die module is vir 15 krediete
3. Operasionele Navorsing 3 is 'n voorvereiste vir hierdie module.
4. Die module word slegs residensieel aangebied.
5. Assessering vir hierdie module bestaan uit weeklikse opdragte en 'n fasebenaderingsprojek.

64009-771 INTRODUCTION TO APPLIED RECOMMENDER SYSTEMS

Course Objective

This course explores the role of recommender systems within data science, machine learning, and AI, covering various approaches such as collaborative filtering, content-based filtering, and hybrid models. Students will learn to preprocess and analyze user and item data, design and implement recommender systems using Python, and evaluate their performance using key metrics. Additionally, the course emphasizes ethical considerations, including fairness, bias, and privacy, while fostering computational thinking and problem-solving skills.

64009-771 INLEIDING TOT TOEGEPASTE AANBEVELINGSTELSLS

Kursusdoelwit

Hierdie kursus ondersoek die rol van aanbevelingstelsels binne datawetenskap, masjienleer en KI, en dek verskeie benaderings soos samewerkende filtrering, inhoudgebaseerde filtrering en hibriede modelle. Studente sal leer om gebruiker- en itemdata vooraf te verwerk en te ontleed, aanbevelingstelsels met Python te ontwerp en te implementeer, en hul prestasie te evalueer met behulp van sleutelmaatstawwe. Verder beklemtoon die kursus etiese oorwegings, insluitend regverdigheid, vooroordeel en privaatheid, terwyl dit rekenaardienke en probleemoplossingsvaardighede bevorder.

Course Content

1. Introduction to Recommender Systems
2. Non-Personalized Recommender Systems
3. Content-Based Filtering
4. Collaborative Filtering
5. Hybrid Recommender Systems
6. Advanced Topics in Recommender Systems
7. Evaluation and Bias in Recommender Systems
8. Capstone Project

Remarks

1. Students who follow this module must be able to program in Python.
2. This module counts 15 credits.
3. The module is available to residential students only.

Kursusinhoud

1. *Inleiding tot Aanbevelstelsels*
2. *Nie-gepersonaliseerde Aanbevelstelsels*
3. *Inhoudgebaseerde Filtrering*
4. *Samewerkende Filtrering*
5. *Hibriede Aanbevelstelsels*
6. *Gevorderde Onderwerpe in Aanbevelstelsels*
7. *Evaluering en Vooroordeel in Aanbevelstelsels*
8. *Slotprojek*

Opmerkings

1. *Studente wat hierdie module volg, moet kan programmeer in Python.*
2. *Die module tel 15 krediete.*
3. *Die module is slegs aan residensiële studente beskikbaar.*