



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

Department of Industrial and
Systems Engineering

Postgraduate Guide 2019



CONTENT

	Page no.
1 General	2
2 Scope of postgraduate study	2
2.1 Honours Degrees	2
2.1.1 BEngHons (Industrial Engineering) (12240012)	3
2.1.2 BSchHons (Applied Science) (Industrial Systems) (12243002)	4
2.2 Masters Degrees	5
2.2.1 MEng (Industrial Engineering) (12250012)	5
2.2.2 MSc (Applied Science) (Industrial Systems) (12253060)	5
2.3 Doctorate Degrees	6
2.3.1 PhD (Industrial Engineering) (12263002)	6
2.3.2 PhD (Industrial Systems) (12263132)	6
2.4 Engineering knowledge and language proficiency	6
3 Applications, registration, fees and funding	6
4 Research	7
4.1 Research Topic	7
4.2 Submitting the Topic	7
4.2.1 Proposal Document and Library Resources	8
4.2.2 Proposal Approval	8
4.3 Registration of Titles	8
4.4 Deliverables	9

APPENDICES

	Page no.
A. Contact detail	10
A1 Department of Industrial and Systems Engineering: Honours, Masters and PhD enquiries - Curriculum, Class Timetables	10
A2.1 Engineering Student Administration (EBIT): Applications for Honours	10
A2.2 Engineering Student Administration (EBIT): Registration and Administration for Honours	10
A2.3 Engineering Student Administration (EBIT): Applications, Registration and Administration for Masters	10
A2.4 Engineering Student Administration (EBIT): Applications, Registration and Administration for PhD	10
A3 Student Service Centre (SSC) Applications, Student accounts, Fees and funding, Bursaries and loans	10
B. Module descriptions	11
C. Timetable	19

FOREWORD

The purpose of this brochure is to present information that prospective and registered students may use in furthering their studies in the Department of Industrial and Systems Engineering (IE). Registered students are expected to familiarize themselves with the information contained in, but not limited to, this brochure. The following sources should be consulted if students (both prospective and registered students) have any further queries about postgraduate studies. All contact details are shown in Appendix A.

- **Yearbooks and General Regulations, Rules & Glossary of Terms:**

This information brochure should be read in conjunction with the Yearbook of the (EBIT Faculty) University of Pretoria. Please follow the website link mentioned herewith: <http://www.up.ac.za/yearbooks/home>

Note:

The most recent version of the brochure will be published on the departmental website as stated above. All matters pertaining to the administration of postgraduate activities is the responsibility of the Head of the Department IE

Although every attempt has been made to ensure that this brochure is correct and up to date at the time of publishing, the Department reserves the right to make any changes without prior notice and without prejudice.

1 GENERAL

1.1 ClickUP

ClickUP is the online learning management system of the University of Pretoria that acts as a virtual classroom. All Postgraduate students (including Masters and PhD students) will have access to ClickUP once registered. Students will be able to login via "MyTUKS Login" from the Homepage on the University of Pretoria's website. Students will then be navigated to the "UP Student Portal" where his/her registered modules (ClickUP courses for each subject and the "industrial_postgraduate_2018" departmental ClickUP course) will be listed. Each module has a unique site that contains lecturer details, study guide, course structure, prescribed material, and announcements. It also hosts facilities to conduct online discussions and e-mail communication(s). Since ClickUP is the official means through which lecturers communicate to all students, students must visit ClickUP regularly and ensure that their latest e-mail addresses are registered in ClickUP.



Additional information may be obtained from the **Student Help Desk** at:

- E-mail: studenthelp@it.up.ac.za
- Tel: +27 12 420 3837

1.2 Policies, Professional and ethical conduct

It is expected of students and lecturers to follow the University's policies and to display professional conduct in all activities related to post graduate studies, including matters such as: class conduct, plagiarism, copyright, referencing and students with special needs apply. Please visit the EBIT Faculty webpage on Research Ethics and Integrity: (<http://www.up.ac.za/en/faculty-of-engineering-built-environment-it/article/15815/faculty-committee-for-research-ethics-integrity>). Application forms, Declaration by researcher- and Informed consent forms may be downloaded from the above-mentioned webpage.

Ethical clearance

Students and lecturers that intend to do research using questionnaires or interacting with industries in related ways MUST obtain EBIT ethical clearance before compiling the questionnaires.

2 SCOPE OF POSTGRADUATE STUDY

The core mission of the University is research and instruction. The process, as followed in the IE department, comprises four distinct phases: undergraduate, honours, masters and doctorate. The first phase (undergraduate), which leads to a bachelor's degree, introduces students to the Industrial Engineering field of study. The educational philosophy is aimed at emphasizing understanding and insight and at developing a scientific thought process rather than learning of facts. The emphasis is on a systems approach to problem identification and solution, while an entrepreneurial and client orientation is stressed. A project is required as partial fulfilment of the requirements for the degree. This phase of study is not dealt with in this guide, since it forms part of the undergraduate studies presented by the Department.

2.1 Honours Degrees

The second phase of the process deals with honours degrees, which entail the completion of 128 academic credits from a prescribed curriculum. The curriculum is dependent on the prospective student's academic qualifications. Module descriptions, with their respective credits and possible prerequisites, appear in

Appendix B towards the back of the brochure. Students should take note that **not all modules are presented each year**, and should therefore consult the timetable in Appendix C when selecting modules. The applicable timetable is available on the last page of this brochure and will be posted on the Departmental website, ClickUP as well as the Postgraduate notice board at the department's entrance. Students who wish to enrol for full-time studies must complete the curriculum in one year. Students who wish to enrol for part-time studies must complete the curriculum in two years. Class- and exam attendance is compulsory and are scheduled in Block Weeks (See timetable).

The postgraduate modules are structured to provide focussed study and specialisation is provided in the following three areas:

- *Business Process Optimisation (BPO)*
- *Resource Optimisation (RO)*
- *Supply Chain Engineering (SCE)*

Modules that form part of the three research streams will be indicated in brackets. If students are interested in pursuing a particular stream, they are advised to consult the HOD of the Department. A minimum number of modules in any specialisation area is not required, but students are advised to focus studies by taking as many modules from their selected study focus area as possible. This will enhance opportunities for Master and Doctoral study.

2.1.1 BEngHons (Industrial Engineering) (Course code: 12240012)

Minimum requirement/s:

Students with an appropriate South African **BEng** degree who have achieved an average of at least 50% during the final year of undergraduate studies may apply for admission to the above-mentioned **BEng (Hons)** degree. International students with an appropriate **BEng** degree who have achieved an average of at least 60% during the final year of the study may apply for admission to the **BEng (Hons)** degree. The postgraduate curriculum for a particular student is however based on whether the student has completed undergraduate studies in Industrial Engineering or not. Students must complete a total of (128 academic credits) from the prescribed curriculum to meet with degree requirements.

Prescribed Curriculum for 2018

Compulsory Research Component:

All students must register for the following compulsory research module (32 credits)

First- or Second Semester 2018*

Industrial and systems engineering research (32 credits)

BCS 780

**Pre-requisites*

Relevant Core module

**IMPORTANT during registration, Pre-requisites:*

*All Hons students must have enrolled and passed at least one *Core module before enrolling for the research module BCS 780. Students may register for BCS 780 ONLY if they have consulted with a potential supervisor prior to enrolling for the module. The Core module must be relevant to the research field the student wishes to pursue for BCS 780.*

Core Modules:

Students must register for a further (96 credits) of which at least (64 credits) must be from the IE department.

First Semester 2019

Enterprise engineering & research methods (BPO) (32 credits)

Supply chain processes (SCE) (16 credits)

Operations research (RO) (32 credits)

BBA 781

BLK 781

BOZ 780

**Pre-requisites*

BID 320 / equivalent

Second Semester 2019

Manufacturing planning & control systems (SCE) (32 credits)

Supply chain design (SCE) (16 credits)

BPZ 782

BVK 780

BLK 781 / equivalent

Elective module/s:**Second Semester 2019**

Design and analysis of experiments (SCE) (16 credits)
Reliability Engineering (BPO) (16 credits)

BDE 780 *BES 220 / BAN 780*
BTH 780

Other Elective Modules:

Students are allowed to take **elective modules** worth (32 credits) at honours (700) level **offered by other departments** but related to the Industrial Engineering field, to make up the required total of (128 credits). **Such modules**, typically presented by the Graduate School of Technology Management (GSTM), Information Technology (IT), other Engineering departments or Mathematics, **require the approval of the Head of the IE department. Module descriptions must be provided. Students should take the scheduling of the courses into consideration to avoid possible timetable clashes.**

****IMPORTANT during registration, Pre-requisites:***

If students are from another institution than the University of Pretoria, they are required to bring proof of modules (academic record and study guide) which could be counted as pre-requisite equivalent module/s to above-mentioned modules.

2.1.2 BScHons (Applied Science) (Industrial Systems) (Course code: 12243002)**Minimum requirement/s:**

NOTE: The minimum requirement will ***increase for 2020**. The new admission requirement/s will be communicated officially in the EBIT Faculty brochure. (the link to this document will be provided)
South African students with an appropriate **BSc or BTech degree** who have achieved an average of at least ***65%** during the final year of the undergraduate degree, may apply for the **BScHons (Applied Science) degree**. International students with an average of at least ***65%** will be considered by the Head of the department. Students must complete a total of (128 academic credits) from the prescribed curriculum to meet with degree requirements.

Prescribed Curriculum for 2019**Compulsory Research Component:**

All students must register for the following compulsory research module (32 credits)

First- or Second Semester 2019*

Industrial and systems engineering research (32 credits)

BCS 780

****Pre-requisites***

Relevant Core module

****IMPORTANT during registration, Pre-requisites:***

*All Hons students must have enrolled and **passed at least one *Core module before enrolling** for the research module BCS 780. Students may register for BCS 780 ONLY if they have consulted with a potential supervisor prior to enrolling for the module. The **Core module must be relevant to the research field** the student wishes to pursue for BCS 780.*

Compulsory module:

All (BScHons AplSci) students must further register for the following compulsory module (16 credits):

First Semester 2019

Industrial analysis (16 credits)

BAN 780

Core Modules:

Students must register for a further (80 credits) of which at least (64 credits) must be from the IE department.

First Semester 2019

Enterprise engineering & research methods (BPO) (32 credits)
Supply chain processes (SCE) (16 credits)
Operations research (RO) (32 credits)

BBA 781
BLK 781
BOZ 780

****Pre-requisites***

BID 320 / equivalent

Second Semester 2019

Manufacturing planning & control systems (SCE) (32 credits)
Supply chain design (SCE) (16 credits)

BPZ 782**BVK 780***BLK 781 / equivalent***Elective module/s:****Second Semester 2018**

Design and analysis of experiments (SCE) (16 credits)
Reliability Engineering (BPO) (16 credits)

BDE 780*BES 220 / BAN 780***BTH 780****Other Elective Modules:**

Students are allowed to take **elective modules** worth (16 credits) at honours (700) level **offered by other departments** but related to the Industrial Engineering field, to make up the required total of (128 credits). **Such modules**, typically presented by the Graduate School of Technology Management (GSTM), Information Technology (IT), other Engineering departments or Mathematics, **require the approval of the Head of the IE department. Module descriptions must be provided. Students should take the scheduling of the courses into consideration to avoid possible timetable clashes.**

****IMPORTANT during registration, Pre-requisites:***

If students are from another institution than the University of Pretoria, they are required to bring proof of modules (academic record and study guide) which could be counted as pre-requisite equivalent module/s to above-mentioned modules.

2.2 Master's Degrees

The third phase, which leads to a Master's degree, requires a dissertation as a deliverable. Some pre-defined projects may be available on the departmental website <http://www.up.ac.za/en/industrial-and-systems-engineering/article/2005687/masters-and-doctorate-research-topics>. Please consult with the concerned lecturer as indicated. Students may also provide their own research topic. NOTE - Students have to submit their **Masters proposal to the Department** and collaborate with a proposed/selected supervisor. Students may thereafter **upon approval, apply and register** for the relevant Master's degree. Please also read the Research section on page 7 of this brochure.

2.2.1 MEng (Industrial Engineering) (Course code: 12250012)

Requirement: An appropriate **BEng(Hons)** degree.

The following module is required: Dissertation (Eng) BIR 890

2.2.2 MSc (Applied Science) (Industrial Systems) (Course code: 12253060)

Requirement: An appropriate **BScHons (Applied Science) (Industrial Systems)** or equivalent as determined by the Head of the Department.

Only after approval of the research topic may the student register for the module: Dissertation BIR 891
A dissertation is a report on a major investigation or research (1 280 hours)¹, and is presented as part of the requirements for the degree.

The dissertation must, amongst other matters, prove the student's ability to undertake scientific research and to report thereon. A dissertation is acceptable if it proves that a student:

- is conversant with the nature and aim of the research,
- has a satisfactory knowledge of the literature concerned and can interpret it,
- has mastered the techniques relevant to his/her research,
- has sound knowledge of both the theory and the practice of scientific methodology,
- is able to evaluate the scientific relevance of his/her findings, and
- can structure the report on the research scientifically with accountability. This inter alia means that the student may not have previously submitted the dissertation for graduation purposes at another tertiary institution.

It is a matter of not evaluating the dissertation, but the student, who must furnish proof of his/her ability by means of the dissertation. Examiners consider the above criteria during an oral examination. During the course of the studies, each registered Masters student will be expected to submit a progress report at the annually.

¹ According to the standards set by the South African Qualifications Authority (SAQA), and the syllabus modules indicated in the Engineering Yearbook, a dissertation has been allocated 128 credits - each credit representing 10 hours of study.

2.3 Doctorate Degrees

The fourth phase of research, which leads to a doctorate, contains no formal training in the form of prescribed subjects. It requires the preparation of a thesis by the student based on his/her own independent and original research as a positive contribution towards the development of science and the existing body of knowledge of the subject. The requirements for the thesis are based on, but not limited to, the requirements for a dissertation, with the important addition of the student's ability to prove that he/she can plan, initiate, and execute independent and original research.

Students from applied sciences will receive a doctorate in Industrial Systems. Some pre-defined projects may be available on the departmental website <http://www.up.ac.za/en/industrial-and-systems-engineering/article/2005687/masters-and-doctorate-research-topics> please consult with the concerned lecturer as indicated. Please also read the Research section on page 7 of this brochure.

NOTE - Students have to submit their **Doctorate proposal to the Department** and collaborate with a proposed/selected supervisor. Students may thereafter **upon approval, apply and register** for the relevant Doctorate degree.

2.3.1 PhD (Industrial Engineering) (12263002)

The student should register for the following module: Thesis BIR 990

2.3.2 PhD (Industrial Systems) (12263132)

The student should register for the following module: Thesis BIT 990

2.4 Engineering knowledge and language proficiency

All applicants who desire to carry out postgraduate study in the Industrial Engineering department are required to have the appropriate engineering and mathematical background and English language proficiency to successfully complete their studies using the written and spoken word.

Should the Head of the DISE detect a deficiency of the nature described above it may be requested that the candidate embark on a prescribed program of improvement to ameliorate the identified shortcoming before gaining enrolment as a postgraduate student.

3 APPLICATIONS, REGISTRATION, FEES & FUNDING

3.1 Applications

The closing dates for applications for admission in 2019 are:

- **For Honours studies:**
Online applications closed for 2019
Hard copy applications: Friday 30 November 2018 (Please consult the Department)
- **For Master's and Doctorate studies:** No closing date. May consult the Head of Department continuously during the year.

Follow the link from the University of Pretoria main webpage, <http://www.up.ac.za/postgraduate-students> Information for Postgraduate Students. Prospective students will find various relevant links from there, such as applying for admission, finances, and electronic yearbooks. A copy of the *General Regulations and Information*, discussing the formal process of registration and renewal of registration in its Section B, is available online. Prospective students should at first apply for admission to the University of Pretoria Campus. Application for admission can be done either online, or by requesting forms from the Client Service Centre. Progress of the admission process can be tracked online.

Once admitted, application forms are forwarded to the Faculty of Engineering, Built Environment and Information Technology (EBIT) for verification of previous qualifications. Students should take note that their application for admittance should be done timeously to ensure their registration forms are available on the date of registration.

3.2 Registration

Once a student has been admitted to the University of Pretoria and the EBIT Faculty, he/she may register for modules online. **Online registrations will be open in January 2019.**

Students should register as soon as possible to ensure that they gain access to the course material - preparatory work and/or assignments which may be required. Such preparatory work will be indicated in the module study guide². The first registration for a master's degree and a doctorate may take place at any time during the year, but the registration should be renewed at the beginning of each consecutive year, until the degree is awarded. After successful registration, students will have access to *Student On-line Services* via the UP Student Portal.

Student On-line Services allow students to view their registered subjects, account status, payment history, academic records, and on-line results. Payments and electronic interaction in specific courses can also be initiated from this site. Late registrations will only be considered in exceptional circumstances.

3.3 Tuition Fees and Funding

Please refer to the "**Fees and Funding webpage**" (<http://www.up.ac.za/fees-and-funding>) which gives details regarding tuition fees, scholarships and loans. Fees are revised annually. *2018 Fees are indicated below. 2019 fees are not yet available and will be updated on the above-mentioned webpage once available.

3.3.1 Initial payments for applications and registration

A Non-refundable application fee of R300 is payable with submission of application for studies. All postgraduate registration and re-registration initial payments will be R7 500 for 2018 registration for current and new students. Registration fee is payable at least 5 days before registration.

3.3.2 Tuition fees

Please contact the Student Service Centre (SSC), Student Accounts for quotations on tuition (Tel: 012 420 3111, ssc@up.ac.za)

NOTE - Tuition fees are subject to annual increases.

Honour's Degrees - Coursework:

BEngHons and BScHons (Applied Science): Estimated cost is R36 400

Master's Degrees - Research Dissertation:

MEng and MSc (Applied Science): R16 330 per annum

Doctorates - Research Thesis:

PhD Industrial Engineering and PhD Industrial Systems: R17 500 per annum

3.3.3 International students

Non-South African students are, for the duration of their studies, required to annually pay an international administration levy in addition to the registration fee. The levy fee is R3 130, payable at least 5 days before registration.

4 RESEARCH

The following section is applicable mainly to students enrolling for Master's and Doctorate studies.

4.1 Research Topic

A prospective student should select a research topic in collaboration with the staff of the Department of Industrial and Systems Engineering. Research topics may be chosen within the three research streams and other topics may be considered in consultation with the HoD.

The following are research focus streams within the Department of Industrial and Systems Engineering:

- *Business Process Optimisation (BPO)*
- *Resource Optimisation (RO)*
- *Supply Chain Engineering (SCE)*

4.2 Submitting the Topic

Students may **propose their own topics** and preferably, identify the supervisor within the department. If not, students are advised to consult with the HOD. Students should then submit their proposal documents to the specified supervisor. Alternatively, students may **choose from current research topics in the department**. The list of available topics is published on the departmental webpage under postgraduate programmes, please follow the following link: <http://www.up.ac.za/en/industrial-and-systems-engineering/article/2005687/masters-and-doctorate-research-topics>

For more information, and to apply for these topics please feel free to contact the document authors. The proposed supervisor will determine final approval.

4.2.1 Proposal Document and Library resources

The document should include a complete project plan that addresses technical deliverables, time scales, and costs. A copy must be submitted to Mrs Hanli Helm at hanli.helm@up.ac.za. The problem/opportunity must be postulated clearly, and details must be furnished of the environment in which the study will be conducted. Sketches, photographs, and diagrams usually make it convenient for an outsider to understand the problem. The scope of the work, as well as the planned approach and the perceived route, is important. Any presentable work that has been completed beforehand (e.g. an overview model or prototype), should be presented as well.

The document may not exceed 10 pages and should address the items as proposed in the following structure:

- **Introduction/Background**
- **Problem statement**
What is the problem/opportunity addressed by the student?
- **Purpose and scope of the research**
What does the student wish to achieve?
What are the boundaries for the research?
Which specific deliverables will be presented and how will the problem be solved?
- **Approach**
Which steps will be taken in the execution of the research?
Which techniques/resources will be used and how will these be obtained?
What cost does the research entail, and how will it be covered through the solution's perceived advantages?

Please consult the '*Postgraduate research guidelines S0001E03*' available on the Departmental website (Postgraduate Academic Programmes).

Library Resources

Students who have already consulted with a supervisor in the department and who have been advised to utilize the University of Pretoria's library resources may apply and register for the following programme and gain access to the library with a student card:

Engineering Postgraduate (Non-degree purposes) (Course code 12290001)

Masters students will be registered for the following module: ZZZ 777

Doctorate students will be registered for the following module: ZZZ 888

Students must obtain their student card from the Student Services Centre (SSC) to gain access to the library.

4.2.2 Proposal Approval

Once the supervisor has approved a proposal, the candidate will be informed in writing, from where the candidate can formally apply and register for the Masters or PhD.

4.3 Registration of Titles

As soon as the title of the dissertation/thesis has been determined, it should be registered by the study Supervisor. The Faculty handles the administration of the registration of the title. After the Faculty has registered and approved the title, the student will receive a letter of confirmation from EBIT Student Administration. Titles of approved dissertations/theses may only be changed with the approval of the Postgraduate Committee of the Faculty.

Titles should be short, but reflect the subject of the dissertation/thesis unambiguously. A short title only suggests the theme, while a lengthy one summarizes the content. Both are unacceptable.

Consider the following examples:

- **Short title** - *Theatre design*
It is not clear which type of theatre is involved; which aspects of design are dealt with; whether the process only, or norms only, are in question; whether it is an historical survey and whether decor and costume design is included. In other words, the title is too vague.
- **Long title** - *An empirical survey of the influence of the physical layout of hospital theatres on operating procedures, with special reference to the hospitals of the Gauteng Province*
The title is too long and clumsy. Whatever the length of the title, it is the construction and choice of words that convey the emphasis and meaning.

The full title should not be written in capital letters, and key words should not start with capital letters. Apply the accepted grammatical rules. The article (a, an, the) is omitted at the beginning of the title. The title as approved by the Faculty must appear verbatim on the examination copy.

4.4 Deliverables

Details regarding the content and technical editing of the deliverables are contained in the “**Postgraduate Research Guide**” available at the bottom of the departmental webpage - <http://www.up.ac.za/en/industrial-and-systems-engineering/article/45575/postgraduate>.

APPENDICES

A. CONTACT DETAIL

A1 Department of Industrial and Systems Engineering

Webpage: <https://www.up.ac.za/industrial-and-systems-engineering>

Honours, Masters and PhD enquiries: Curriculum, Class Timetables

Contact person **Mrs Hanli Helm**
 Contact details Tel: +27(0)12 420 5230, Fax: +27(0)12 362 5103
 E-mail: hanli.helm@up.ac.za
 Physical address Department of Industrial and Systems Engineering, University of Pretoria
 Engineering Building II, Room 3-13
 c/o Lynnwood Rd and Roper St, Pretoria
 Postal address Department of Industrial and Systems Engineering, University of Pretoria
 Private bag X20, Hatfield, 0028
 Office hours Monday - Friday 07:30-16:00

A2 Engineering Student Administration (EBIT)

Webpage: <http://www.up.ac.za/faculty-of-engineering-built-environment-it>

Physical address EBIT Student administration, University of Pretoria
 Engineering Building I, Room 6-9
 c/o Lynnwood Rd and Roper St, Pretoria
 Postal address EBIT Student administration, University of Pretoria
 Private bag X20, Hatfield, 0028
 Office hours Monday - Friday 07:30-16:00

A2.1 Administration of Applications for: Honours degrees

Contact person **Ms. Sibongile Mgiba**
 Contact details Tel: +27(0)12 420 5316
 E-mail: laurine.mgiba@up.ac.za

A2.2 Administration and Registration for: Honours degrees

Contact person **Mrs. Nelisa Kenene**
 Contact details Tel: +27(0)12 420 6520
 E-mail: nelisa.kenene@up.ac.za

A2.3 Applications, Registration and Administration for Masters and PhD degrees

Contact person/s **Ms. Stefanie Steenberg** (Office: Engineering I, 6-5.1)
 Contact details Tel: +27(0)12 420 5315, Fax: +27(0)86 544 4640
 E-mail: stefanie.steenberg@up.ac.za

A2.4 Applications, Registration and Administration for PhD degrees

Contact person/s **Mr. Kenneth Nkanyana** (Office: Engineering I, 6-8.1)
 Contact details Tel: +27(0)12 420 6735, Fax: +27(0)86 544 4640
 E-mail: kenneth.nkanyana@up.ac.za

A3 Student Service Centre (SSC) Enquiries on student accounts, fees & funding

Webpage: <http://www.up.ac.za/enquiry>

Applications, Student accounts, Fees dan funding, Bursaries and loans:

Contact details Tel: +27(0)12 420 3111, Fax: +27(0)12 420 4555
 E-mail: ssc@up.ac.za
 Physical address Student Service Center, University of Pretoria
 c/o Lynnwood Rd and Roper St, Pretoria
 Postal address Private bag X20, Hatfield, 0028
 Operating hours Monday - Friday 08:00 - 16:00

B. MODULE DESCRIPTIONS

BAN 780 Industrial analysis

Credits: 16

***Compulsory for BSc(Hons) ApISci students. Can be taken as elective module by Engineering students who did not complete an Industrial Engineering undergraduate degree. It CANNOT be taken by students who completed an Industrial Engineering undergraduate degree ***

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

- Descriptive modelling: Engineering Statistics (self study)
- Predictive modelling: Simulation Modelling
- Prescriptive modelling: Operations Research

Note that the Descriptive modelling theme is assessed during the first scheduled class in block-week 1 and counts 50% of the semester mark. Study material for the theme is available on clickUP.

BAN 780 serves as pre-requisite for BDE 780.

BAO 780 Advanced aspects of Operations Research (Elective module)

Credits: 16

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

Decision makers are frequently faced with complex problem environments. The module introduces two advanced topics in the field of Operations Research that can assist in the development of more relevant decision support models. The first topic deals with multi objectivity and introduces a variety of interventions to incorporate the competing objectives into mathematical programming models. Secondly, the topic of Data Envelopment Analysis (DEA) is introduced, a non-parametric method used to empirically measure the productive efficiency of decision-making units. This linear programming methodology allows the decision maker to measure the productivity in complex environments with multiple inputs and outputs; uncover often-overlooked relationships between in- and outputs; and analyse and quantify the inefficiencies of every unit evaluated.

¹BAR 780 Solution Algorithms in Operations Research (Core module)

Credits: 32

Academic organisation: Industrial and Systems Engineering

**Pre-requisite: BAN 313 or BAN 780*

Contact time: 36 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

When developing decision-support models using optimisation, the computational burden is often so great that exact optimal solutions are not attainable, or not efficiently found, especially in combinatorial and discrete optimisation problems. Often approximate solutions are adequate and can provide superior solutions to the current state-of-practice decision approaches. The module introduces a selection of heuristics and metaheuristics applied to a variety of problems frequently faced by Industrial Engineers. The module also introduces a methodology to test and validate heuristics to ensure robust and reliable application. The module will focus on exact, heuristic and meta-heuristic optimisation algorithms, and introducing research methodologies specifically applicable to the field of operations research.

¹Students are encouraged to take this module in conjunction with BDE 780 and BOZ 780

BBA 781 Enterprise engineering and research methods (Core module)

Credits: 32

Academic organisation: Industrial and Systems Engineering

**Pre-requisite: Information systems design (BID 320) or similar/equivalent course*

Contact time: 36 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module Content: *Following on next page*

Module Content:

Enterprise Engineering can be defined as the body of knowledge, principles, and practices to design an enterprise. Due to their complexity and the continuously changing environment, enterprises need new approaches, tools and techniques to deliver innovative products and services to new markets in competitive environments. This module offers an introduction to the engineering design process applied to the enterprise as a system, and present existing approaches for designing, aligning and governing the enterprise. Within the design paradigm, the module also offers research methods (e.g. design research and action research) that are relevant for doing research within the enterprise engineering discipline.

The module covers:

- Background on systems thinking
- Systems design and systems engineering
- Prominent approaches for creating an enterprise engineering capability (e.g. Zachman, The Open Group, Dietz/Hoogervorst).
- Mechanisms and practices associated with different phases of enterprise design (e.g. enterprise modelling, languages, road maps, maturity assessment etc.)
- Research methods and techniques to validate and extend the EE knowledge base
- Case studies
- Change management

BCI 780 Supply chain information & decision technology (*Elective module*)**Credits: 16****Academic organisation:** Industrial and Systems Engineering**Contact time:** 24 contact hours per semester**Period of presentation:** Semester 1 or 2**Language of instruction:** English**Module content:**

Information technology is an important enabler of effective supply chain management, typically spanning the extended value chain from suppliers to customers. The timeliness and availability of relevant information are critical when applying supply chain strategies that increase service levels of and reduce cost and lead times. Value-added IT-based services are increasingly used to differentiate and develop relationships with customers.

The objective of the course is:

- To develop a sound understanding of components and priorities
- IT investment to enable supply chain integration and efficiency,
- The impact of business process change on IT implementation and selection of decision support systems
- The value of information
- Leveraging financial information
- Advanced supply chain planning and execution
- Decision support systems
- IT capabilities for supply chain excellence
- Enterprise resource planning
- Systems advanced planning and scheduling systems
- Identification technology
- Integrating supply chain IT

BCS 780 Industrial and systems engineering research (*Compulsory module*)**Credits: 32****Academic organisation:** Industrial and Systems Engineering

**Pre-requisites: Within chosen study field – Any one of the following Core modules: BBA 781, BPZ 782, BAR 780, BOZ 780, BUY 780, BGH 780, BLK 781, BVK 780.*

Contact time: 24 contact hours per semester**Research percentage:** Approximately 40%**Period of presentation:** Semester 1 or 2**Language of instruction:** English**Module content:**

The module affords an individual student the opportunity of studying a designated area of coherent knowledge under the tutorship of a senior staff member of the Department of Industrial and Systems Engineering. Eligibility, topic and scope of the intended project must be determined in consultation with the proposed supervisor.

BDE 780 Design and analysis of experiments (*Elective module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

**Pre-requisites: BES 220 or equivalent as approved by the Head of the Department demonstrated. Students who have completed another statistical course must apply for acceptance to this module by writing a letter, which demonstrates equivalence of courses.*

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

The design of an experiment may be defined as 'the logical construction of an experiment in which the degree of uncertainty with which the inferences are drawn may be well defined'.

The module covers:

- Principles of experimental design (randomisation, replication and blocking, local control)
- One-Factor-Two-level factorial designs
- One-Factor-Multi-level factorial designs
- Completely Randomised Design (CRD) and introduction to ANOVA
- Randomised Complete Block Design (RBD)
- Latin Square Design (LSD)
- Balanced Incomplete Block Design (BIBD)
- Factorial experiments (2nd and 3rd factorial experiments)
- Blocking and confounding in factorial designs
- Overview of fractional factorial designs

BEE 780 Inventory modelling (*Elective module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

- Theory of Inventory Systems: Inventory models and modelling including time and certainty complexities, linear and non-linear systems and feedback systems
- Review of inventory models: Types and representations (classic, shortage, capacity constraint, time
- Review of important inventory papers, their approaches and their focus
- Modelling and solution techniques: characterisation and assumptions, mathematical modelling, mathematical programming, heuristics, simulation models, Control Theory and other approaches
- State of the art of modelling: current challenges and research trends
- Technological solutions of inventory modelling and management: algorithms and software, integration to MRP, ERP and scheduling modules, integration to WMS modules, and demonstrations

BES 780 Applied engineering statistics (*Elective module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

This module presents an applied approach to solve real-world engineering problems. The premise of the course is that data analysis, and thus, applied statistics, is an inseparable part of conducting research and solving engineering problems. The module presents the elements of different types of statistical studies as they relate to different industrial settings. The aim of the module is to promote inductive reasoning through the gathering, analysing and interpreting of diverse types of observational data. The outcome of the module is an engineer equipped to select and apply statistical methods appropriate to an industrial setting.

The module covers:

- Contextualisation: different types of industrial processes and research settings, related types of statistical studies and a framework for understanding and applying statistics, principles of probabilistic and rational data gathering

- The use of common and specialised probability distributions (such as the Gamma, Exponential and Weibull distributions) in solving real-life problems, conducting scientific research and analysing stochastic and deterministic processes
- Data transformations: when and how to transform data
- Bridging the gap between technology and statistical analysis: The use of EXCEL in resolving basic and advanced statistical problems

BGH 780 Quality management (*Core module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

Professionally, engineers are confronted with issues related to product quality and performance or organisational excellence. The intention of this course is to provide an overview of the domain of modern quality management and to equip the student with theory, methodologies and tools and techniques to improve and achieve product quality and performance excellence.

The module covers:

- Contextualisation: the history, guru's, principles, industrial setting and the domain of Quality Management
- Practices of improving and achieving product quality: role in industrial engineering, online and offline quality control practices
- Frameworks of improving organisational excellence: National Quality Awards, ISO 9000 and other frameworks
- Practices of improving performance excellence: quality and competitive advantage, customer and supplier relationships, people empowerment and motivation, quality Leadership and organisational change

BHM 780 Probability models (*Elective module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

The objective of the module is that students be exposed to probability theory, learn the ability to follow fairly involved theoretical reasoning, continue to learn how to reason mathematically, and solve problems of a more practical nature.

The module covers:

- Probability theory: random variables and random vectors, Sequence of random variables, transformation of probability distributions, stochastic processes: examples of stochastic processes; various types of stochastic processes
- Poisson processes: homogeneous and non-homogeneous stochastic processes with examples
- Renewal processes: renewal functions; ordinary and delayed renewal processes; regenerative stochastic processes
- Discrete-time Markov chains: continuous time Markov chains with focus on examples in reliability, queuing and inventory models

BIS 780 Information systems (*Elective module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

**Pre-requisites: Information systems design BID 320, Production BPZ 410 – for Industrial Engineering students prior to 2003. Similar course presented by Information Technology (course content to be provided)*

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content: *Following on next page*

Module content:

To introduce the student with a background in transactional application software development to a variety of aspects in the wider field of information technology. Emphasis is on the functional design of Business Intelligence systems from an Industrial Engineering perspective. The aim is to enable the student to

appreciate the scope of management challenges in the integrated environment of business processes, transactional application software, data, IT infrastructure and telecommunications, data warehousing, and the necessary management information needed at various levels in an organization.

The module covers:

- Technology trends
- Context diagram of application software portfolio
- Review of typical transactional information systems
- Role of Business Intelligence and data warehousing
- Business dimensional lifecycle
- Business requirement definition
- Basic elements of the data warehouse
- Extraction, Transformation and Loading processes
- Dimensional modelling (star schema)
- Metadata
- Information delivery

BLC 780 Lean supply chain strategies and systems (*Elective module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

Supply chain executives need to contribute and support long-term strategic objectives by providing a competitive edge through an aligned supply chain strategy. The course addresses the impact of lean principles in supply chain management and practical approach to implementing lean thinking and demand driven supply chains. The course provides a framework for the strategic supply chain decisions, both in designing and managing an efficient extended supply chain. The latest innovations, trends and challenges in agile supply chain strategies and systems are reviewed. Team leadership skills are developed through practical applications, approaches and best practices of lean supply chain design and management. Supply chain leadership perspectives will be provided by executives and managers from industry and team-based simulation games.

The module covers outline:

- Fundamentals of lean management
- Lean thinking and supply chain (SC) management
- Customer value
- Network design strategies
- Supply chain integration and barriers to integration
- SC performance measurement
- Extended value chain and value stream mapping
- Eliminating waste in the supply chain
- Applying lean principles to supply chain operations
- Inventory positioning approaches
- Operational executive problems
- A3 Performance Management

BLK 781 Supply chain processes (*Core module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

A key objective of supply chain management is to develop competitiveness and achieve a market advantage through the implementation of cross-functional processes as the mechanism to coordinate internal and external activities. The course aims to create an understanding of the importance of integrating key supply chain business processes and to develop the ability to analyse and implement such processes across functional and corporate silos. Standardised process definitions and practices, including strategic and operational sub-processes and key performance measurements, are considered.

The module covers:

- Customer relationship management process
- Supplier relationship management process
- Customer service management process
- Demand management process
- Order fulfilment process
- Manufacturing flow management (planning & control) process
- Product development and commercialisation process
- Returns management process
- Assessment of Supply Chain Management (SCM) processes
- Implementing and sustaining SCM processes
- Supply chain mapping approaches
- Supply chain performance measurement

BMK 780 Process optimization (*Elective module*)

Credits: 16

Academic organisation: Industrial and Systems Engineering

**Pre-requisites: Module only available to students with a BEng Industrial degree*

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

Process optimisation is an engineering discipline, which focuses on the tools and techniques used specifically for business process analysis, design, and optimisation. As physics determines the physical behaviour of tangibles, process physics forms the foundation of business process behaviour. Traditionally, operations research techniques are used by Industrial Engineers to optimise business processes, process optimisation provides a more focused approach using techniques such as Social Network Analysis, System Dynamics, image profiling and process mining to uncover analytical models. The outcome of this course is to enable the student to create an integrated, analytical business process behaviour profile. This supports the analysis, design and optimisation of business processes in a Business Engineering lifecycle. Process optimisation requires an understanding of operations research within the business engineer framework. This course requires a full understanding of undergraduate Industrial Engineering modules as well as an postgraduate understanding of resource optimisation and enterprise architecture.

The module covers:

- Standard process physics principles, facts and models
- Process Intelligence
- Adaptive process control and SMART processes
- Robustness and complexity analysis
- Process mining
- Social network analysis

²**BOZ 780 Operations research** (*Core module*)

Credits: 32

Academic organisation: Industrial and Systems Engineering

Contact time: 36 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

Building on undergraduate modules in Operations Research, the module aims to extend the mathematical programming and optimisation capabilities by introducing uncertainty. Many decision makers are confronted with complex environments in which data is not known with certainty, or in which the decision constraints are uncertain. For cases where one knows the shape, or can assume that the uncertainty follows a known probabilistic distribution, stochastic programming can be used. In the module both chance-constrained programming and fixed recourse are introduced. Fuzzy optimisation is introduced for cases where the shape and/or distribution of the uncertainty are not known. The module also addresses the uncertainty when a decision maker is confronted with multiple, competing objectives.

²*Students are encouraged to take this module in conjunction with BDE 780 and BAR 780*

BPZ 782 Manufacturing planning & control systems (*Core module*)**Credits: 32****Academic organisation:** Industrial and Systems Engineering**Pre-requisite: Operations Management and Operations Research (advisable but not mandatorily required)***Contact time:** 36 contact hours per semester**Period of presentation:** Semester 1 or 2**Language of instruction:** English

Module content:

Review of MPC, Agile Manufacturing Processes, Models of MPC (Details in the attached document).

Section 1: Review of MPC Theories and Framework

Section 2: Research Framework for Problems in Manufacturing Systems

- Mathematical Model based Problems and their techniques
- Estimation and Hypothesis based Problems and their techniques

Section 3: Introduction to MPC Problems and sample Models

- Forecasting models
- Aggregate planning models
- Lot sizing and disaggregation models
- Finite Scheduling models
- Lean Manufacturing Models
- Basic Distribution and Replenishment Models
- Basic Supply Chain Structural Analysis and Performance Models

Section 4: Agile Planning Problems and Techniques

- Multi-Level Master Scheduling Techniques
- Constraint Scheduling – (TOC theory, applications and optimisation)
- Lean Manufacturing Implementation (from Flow Lean to Process Kaizen)
- Introduction to CONWIP ideology
- Introduction to Demand Driven MRP

BSI 780 Business engineering (*Elective module*)**Credits: 16****Academic organisation:** Industrial and Systems Engineering**Contact time:** 24 contact hours per semester**Period of presentation:** Semester 1 or 2**Language of instruction:** English

Module content:

Organisations are complex systems, which consist of people, processes, customers, resources and regulatory environments. Business Engineering (BE) is a discipline which uses an engineering approach towards introducing planned business change into the organisation. This includes formal analysis, design, implementation and maintenance of the holistic business system; requiring a deep understanding and knowledge of the interaction and balance of complex business system elements. The outcome of the course is to enable the student to understand the art and science of engineering complex business systems.

Business engineering is the ultimate pinnacle of industrial engineering competency – being able to construct business systems serving complicated organisational value propositions. The course requires a full understanding of undergraduate Industrial Engineering modules as well as a postgraduate understanding of resource optimisation, enterprise architecture, and supply chain engineering.

The module covers:

- BE principles for design, implementation and optimisation of complex business systems
- BE programme process which governs the implementation of holistic business changes
- BE programme and project structures
- BE Tools and techniques used throughout the BE lifecycle for engineering modelling and optimisation.
- Business
- Models and innovation approaches
- Integrated Business planning
- Business Process reference models for strategic, tactical, core and support processes.

BTH 780 Reliability engineering** (*Elective module*)**Credits: 16*Academic organisation:** Industrial and Systems Engineering**Contact time:** 24 contact hours per semester**Period of presentation:** Semester 1 or 2**Language of instruction:** English

Module content – Follows on the next page

Module content:

To make students conversant with the concepts, tools and techniques of reliability engineering

The module covers:

- Introduction to reliability engineering
- Reliability mathematics
- Probability plotting
- Reliability prediction for design
- Reliability testing
- Reliability growth
- Maintainability
- Reliability management

BUY 780 Simulation modelling (*Core module*)**Credits: 32**

Academic organisation: Industrial and Systems Engineering

**Pre-requisite: BAN 313 or BAN 780*

Contact time: 36 contact hours per semester

Period of presentation: Semester 1 or 2

Research percentage: Approximately 40%

Language of instruction: English

Module content:

In recent years the boundaries between different simulation paradigms such as discrete event simulation, system dynamics and agent-based models have become less distinct. Improvements in computational efficiency also allow much richer and complex models to be built. This course introduces agent-based models (ABM) as a class of computational models that deal with autonomous agents and their interactions with other agents, and their surrounding environments. Course content covers basic theoretical foundations of ABM and then focuses on a few specific application areas where ABM is used for decision-making: pedestrian and transport models; production and logistics; as well as biology.

BVK 780 Supply chain design (*Core module*)**Credits: 16**

Academic organisation: Industrial and Systems Engineering

**Pre-requisites: BLK 781 Supply chain processes*

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Language of instruction: English

Module content:

Strategic design of supply chain networks, inventory management and supply chain integration. Framework for strategic alliances and third party logistics. Analysis and application of alternative supply chain reference models as the basis for modelling, analysis and improvement.

The module covers:

- Supply chain network design
- Strategic management of inventory
- Supply chain integration
- Strategic alliances
- Coordinated product and supply chain design
- Supply chain modelling (SCOR, VRM)

The following modules will NOT be offered by the IE department in 2019:

Advanced aspects of operations research	BAO 780	(<i>Elective module</i>)
Solution algorithms in operations research	BAR 780	(<i>*Core module</i>)
Supply chain information & decision technology	BCI 780	(<i>Elective module</i>)
Quality management	BGH 780	(<i>*Core module</i>)
Inventory modelling	BEE 780	(<i>Elective module</i>)
Applied engineering statistics	BES 780	(<i>Elective module</i>)
Probability models	BHM 780	(<i>Elective module</i>)
Information systems	BIS 780	(<i>Elective module</i>)
Lean supply chain strategies and systems	BLC 780	(<i>Elective module</i>)
Process optimization	BMK 781	(<i>Elective module</i>)
Simulation modelling	BUY 780	(<i>*Core module</i>)
Business engineering	BSI 780	(<i>Elective module</i>)

C. HONS CLASS- AND EXAM TIMETABLE

*Please note changes to the Timetable below concerning Block Week 1 Dates, BAN 780, BLK 781 and BBA 781
 *Please note changes to the Timetable, **Semester 1, Block Week 2 in May: 13-17 May** (Election day on 8 May)

Class- and Examination attendance is compulsory for all Hons. students.
 32-credit Core modules are allocated three contact sessions of four hours each per Block Week.
 16-credit Core /elective modules are allocated two contact sessions of four hours each per Block Week.
 Information session for BCS 780 is published on the Postgraduate webpage.

2019/03/05

First Semester 2019																											
Subject	Contact	Time	March (*BW 1)					May (*BW 2)					June (*BW 3)					June (Exam)					Venue(s) 11-15 March (*BW 1)				
			11	12	13	14	15	13	14	15	16	17	3	4	5	6	7	24	25	26	27	28					
*Industrial Analysis (BAN 780)	Prof Johan Joubert 012 420 2843	08:00-12:00	*																								Eng II 3-40
	Dr Elias Willemse 012 420 3443	13:00-17:00	*																								Eng II 2-37
Supply Chain Processes (BLK 781)	Mr Makoena Sebatjane 012 420 4517	08:00-12:00																									/
		13:00-17:00																									
Enterprise Engineering (BBA 781)	Prof Marne de Vries 012 420 2038	08:00-12:00																									Eng II 3-40
		13:00-17:00																									
Operations Research (BOZ 780)	Prof Johan Joubert 012 420 2843	08:00-12:00																									/
		13:00-17:00	*																								Eng II 2-37

*BCS 780 (Industrial & Systems Engineering Research) Information Session Video Recording available at the following link:
<http://www.up.ac.za/en/industrial-and-systems-engineering/article/45575/postgraduate>

Second Semester 2019																											
Subject	Contact	Time	August (*BW 1)					Sept. / Oct. (*BW 2)					November (*BW 3)					Nov (Exam)					Venue				
			19	20	21	22	23	30	1	2	3	4	4	5	6	7	8	25	26	27	28	29					
Design & Analysis of Experiments (BDE 780)	Mr Wynand Breytenbach 012 420 2376	08:00-12:00																									to be announced
		13:00-17:00																									
Supply Chain Design (BVK 780)	Mr Makoena Sebatjane 012 420 4517	08:00-12:00																									to be announced
		13:00-17:00																									
Reliability Engineering (BTH 780)	Prof Sarma Yadavalli 012 420 2979 Dr Michael Ayomoh 012 420 2832	08:00-12:00																									to be announced
		13:00-17:00																									
Manufacturing Planning & Control Systems (BPZ 782)	Dr Olufemi Adetunji 012 420 5229	08:00-12:00																									to be announced
		13:00-17:00																									

*BCS 780 (Industrial & Systems Engineering Research) Information Session Video Recording available at the following link:
<http://www.up.ac.za/en/industrial-and-systems-engineering/article/45575/postgraduate>

BW Refers to Block Week

*BCS 780 Compulsory for all Hons students

*BAN 780 is COMPULSORY for all BSc (Hons) Apl Sci students

*** BAN BW 1**

The Descriptive modelling theme is assessed during the first scheduled class in block-week 1 and counts 50% of the semester mark. Study material for the theme is available on clickU

BAN 780 class (2nd Session, BW 1) joins BOZ 780 class on Monday 11 March at 13:00

Class sessions are scheduled from either 08:00 - 12:00 AM or 13:00 - 17:00 PM

Class Sessions 

BAN BW 1 

Exams 

IMPORTANT NOTES:

- Please ensure to check for timetable clashes when choosing electives from other Departments, it will not be the obligation of the Department

Last Updated: 2019/03/05



Prof. VSS Yadavalli

Head: Department of Industrial and Systems Engineering