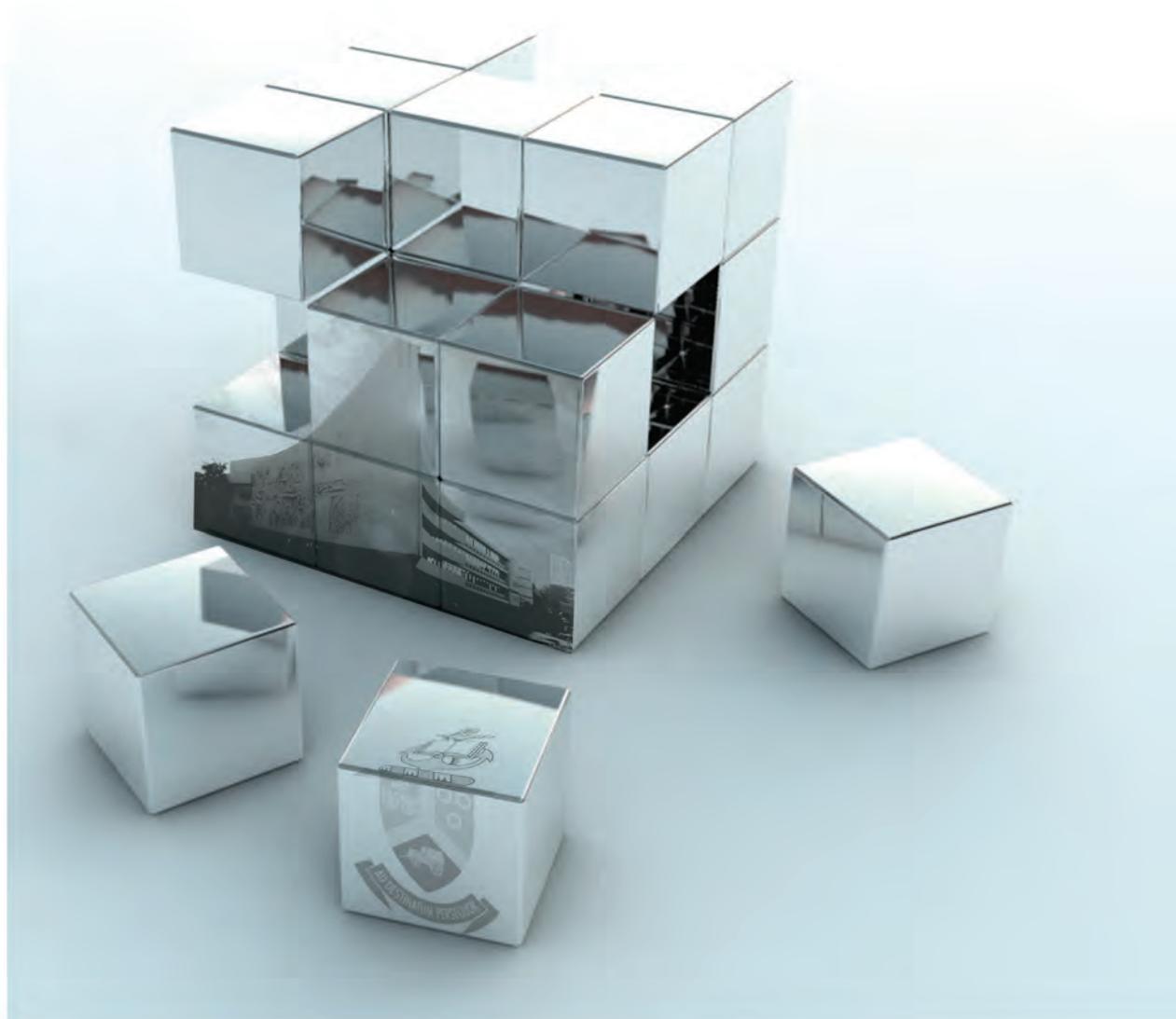


Faculty of Engineering, Built Environment and Information Technology

Department of Industrial and Systems Engineering

Postgraduate Guide 2014



UNIVERSITEIT VAN PRETORIA
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Faculty of Engineering, Built Environment and Information Technology

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School of Engineering: *Department of Industrial and Systems Engineering*

POSTGRADUATE GUIDE

FOREWORD

The purpose of this brochure is to present information that prospective and registered students may use in furthering their studies in the DISE. 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.

- **Departmental administration:**
 - The web page for the Department, available at <http://www.up.ac.za/ie>
 - Miss Hanli Potgieter, available at hanli.potgieter@up.ac.za
 - Head: Department of Industrial and Systems Engineering,
Prof VS Sarma Yadavalli, available at sarma.yadavalli@up.ac.za
- **Faculty administration:**
 - Engineering Administration:
Ms Thabiso Motsei (for Honours), available at thabiso.motsei@up.ac.za
Ms Nadine Ah Dong (Hons Applications, Masters and Doctorate) at nadine.ahdong@up.ac.za
Client Service Centre, available at <http://www.up.ac.za>
- **Yearbooks:**
This information brochure should be read in conjunction with the following Yearbooks of the University of Pretoria which contains all the current regulations and syllabi. Yearbooks are available via the following website link: <http://web.up.ac.za/default.asp?ipkCategoryID=1797&sub=1&parentid=33&subid=16101&ipklookid=1>
The requirements of the Yearbooks will apply irrespective of the information contained in this brochure.
 - 2014 General Regulations and Rules of the University of Pretoria
 - 2014 Faculty of Engineering, Built Environment and Information Technology (Part 1): Regulations and Syllabi
- **Guidelines for post graduate research:**
The *Postgraduate Research Guide* (document S0001E03) of the DISE should also be read by students registering for Master's and Doctoral studies. The research guide is posted on the Departmental website on the postgraduate programmes webpage.

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. 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 of Industrial and Systems Engineering.

1 GENERAL

1.1 ClickUP

ClickUP is the online learning management system of the University of Pretoria that acts as a virtual classroom. Once registered for an honours degree, a student will have access to all modules that he/she is registered for. A central postgraduate portal will give the student access to each individual module and may be accessed from the University's homepage via the information for *Current Students* link. Each module has a unique site that contains lecturer details, a study guide, the course structure and prescribed material. It also hosts facilities to conduct online discussions and e-mail. Since ClickUP is the official means through which lecturers communicate to all students, students must visit ClickUP regularly.



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Students should visit

https://clickup.up.ac.za/bbcswebdav/institution/clickup_help_site/2013/pdf/students/students_where_do_I_see_w_hich_email%20adress_is%20used_for_clickUP_notifications_and_email.pdf

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@up.ac.za
- Tel: +27 12 420 3837
- Website: <http://www.click.up.ac.za/new/students.html>

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. The departmental guidelines

(<http://web.up.ac.za/default.asp?ipkCategoryID=5624&language=0>) with respect to matters such as class conduct, plagiarism, copy right, referencing and students with special needs apply.

Ethical clearance

Students and lecturers that intent to do research using questionnaires or interacting with industries in related ways MUST obtain EBIT ethical clearance

(<http://web.up.ac.za/default.asp?ipkCategoryID=4294&subid=4294&ipklookid=7>) 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 Department of Industrial and Systems Engineering, 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 rote 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, appear in Appendix B. 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 will be posted on the Departmental website, and made available on the postgraduate notice board at the Department entrance. Please ensure to read through the module descriptions at the back of the brochure as subjects may have prerequisites.

The postgraduate modules are structured to provide focussed study. In addition to *Industrial Engineering Foundation* (IEF) modules, specialisation is provided in the following three areas:

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



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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's study.

2.1.1 B Eng (Hons) (Industrial) (Course code: 12240011)

Students with an appropriate South African **B Eng** degree who have achieved an average of at least 50% during the final year of the study may apply for admission to the **B Eng (Hons)** degree. International students with an appropriate **B Eng** degree who have achieved an average of at least 60% during the final year of the study may apply for admission to the **B Eng (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.

Industrial Engineering Graduates

- **Compulsory Modules:**

All students must register for the following compulsory courses (48 credits):

First Semester

Design and Analysis of Experiments (IEF)	BDE 780
Supply Chain Processes (SCE)	BLK 781

Second Semester

Research Methodology (IEF)	INI 781
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- **Elective Modules:**

Students should furthermore, select at least three modules (48 credits) from the following elective modules offered by the DISE:

First Semester

Enterprise Architecture (BPO)	BBA 781
Manufacturing Planning and Control Systems (SCE)	BPZ 782

Second Semester

Quality Management	BGH 780
Operations Research	BOZ 780
Solution Algorithms in Operations Research	BAR 780
Supply Chain Design (SCE)	BVK 780
Business Engineering	BSI 780

The following modules, as offered by the Department, will not be presented in 2014:

Ergonomics	BEE 780
Health and Safety in the Workplace	BGW 780
Information Systems	BIS 780
Reliability Engineering	BTH 780
Probability Models	BHM 780
Simulation Modelling	BUY 780
Supply Chain Information & Decision Technology	BCI 780
Applied engineering statistics	BES 780



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Students are allowed to take **two elective module** (32 credits) at honours (700) level **offered by other departments**, but related to the Industrial Engineering field. Such modules, typically presented by the Graduate School of Technology Management, Information Technology or other engineering departments, require the approval of the Head of the Department of Industrial and Systems Engineering. Students should select, from the other courses listed in Appendix B and by taking the scheduling of the courses into consideration, a sufficient number of courses to make up the required 128 credits.

Non-industrial Engineering Graduates

- **Compulsory Modules:**

Students must register for the following compulsory courses (48 credits):

First Semester

Design and Analysis of Experiments (IEF)	BDE 780
Supply Chain Processes (SCE)	BLK 781

Second Semester

Research Methodology (IEF)	INI 781
----------------------------	----------------

- **Elective Modules:**

Non-industrial engineers should select at least four additional modules (64 credits) from the following elective modules offered by the Department of Industrial and Systems Engineering:

First Semester

Enterprise Architecture (BPO)	BBA 781
Manufacturing Planning and Control Systems (SCE)	BPZ 782

Second Semester

Quality Management	BGH 780
Operations Research	BOZ 780
Supply Chain Design (SCE)	BVK 780
Business Engineering	BSI 780
Solution Algorithms in Operations Research	BAR 780

Students are allowed to take **one elective module** (16 credits) at honours (700) level **offered by other departments**, but related to the Industrial Engineering field. Such modules, typically presented by the Graduate School of Technology Management, Information Technology or other engineering departments, require the approval of the Head of the Department of Industrial and Systems Engineering.

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2.1.2 B Sc (Hons) (Applied Science) (Industrial Systems) (Course code: 12243011)

South African students with an appropriate *B Sc* or *B Tech* degree who have achieved an average of at least 65% during the final year of the degree, may apply for the *B Sc (Hons) Applied Science* degree. International students with an average of at least 65% will be considered by the Head of the Department of Industrial and Systems Engineering. Once the application is approved, the student must complete the following five compulsory modules:

- **Compulsory Modules:**

Students must register for the following compulsory courses (64 credits):

First Semester

Industrial Analysis (Foundation)	BAN 780
Design and Analysis of Experiments (Foundation)	BDE 780
Supply Chain Processes (SCE)	BLK 781

Second Semester

Research Methodology (Foundation)	INI 781
-----------------------------------	----------------

- **Elective Modules:**

Applied science students should select four elective modules (64 credits) from the following modules offered by the Department of Industrial and Systems Engineering:

First Semester

Enterprise Architecture (BPO)	BBA 781
Manufacturing Planning and Control Systems (SCE)	BPZ 782

Second Semester

Quality Management	BGH 780
Operations Research	BOZ 780
Supply Chain Design (SCE)	BVK 780
Business Engineering	BSI 780
Solution Algorithms in Operations Research	BAR 780

2.2 Masters Degrees

The third phase, which leads to a master's degree, requires a dissertation as a deliverable. A distinction is made between the following degrees, each with *Research Methodology - INI 781* as a prerequisite.

2.2.1 M Eng (Industrial) (Course code: 12250011)

All students holding an appropriate *BEng(Hons)* degree may apply to enroll for the degree. The following module is required:

Dissertation (Eng) BIR 890

Students may only register for the module once a research proposal has been submitted, and been approved by the Postgraduate Committee.



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2.2.2 MSc (Applied Science) (Industrial Systems) (Course code: 12253011)

All students holding an appropriate *BSc (Hons) (Applied Science) (Industrial Systems)* or equivalent as determined by the Head of the Department may apply for admission to the degree. The application should be submitted to the Client Service Centre. Once the application is approved the student must submit and present a research proposal to the Head of the DISE for approval. 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 take the above criteria into account during an oral examination. During the course of the studies, each registered Masters student will be expected to present a progress report at the two colloquia arranged per year. The progress presentations are required while the student is conducting the research. The topic approval presentation is included within the three required presentations. Dates for the colloquia are covered in Section 4.2.

4.5. Doctorate

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.

2.3.1 PhD (Industrial Engineering) (12263001)

Thesis BIR 990

2.3.2 PhD (Industrial Systems) (12263131)

Thesis BIT 990

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.



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4.6. 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 embarks on a prescribed program of improvement to ameliorate the identified shortcoming before gaining enrolment as a postgraduate student.

3. APPLICATIONS, REGISTRATION, AND FEES

3.1. Applications

The closing dates for applications for admission in 2014 are:

- **For Honours studies: 15 November 2013**
- **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> to Prospective 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. Copies of the yearbook may also be requested from the Client Service Centre. Prospective students should at first apply for admission to the University of Pretoria Campus. Application for admission can either be done 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 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 Faculty of Engineering, Built Environment and Information Technology, he/she may register for modules. The formally scheduled graduate registration date for 2014 modules is:

- Saturday 25 January 2014 punctually at 08:00

Students submit their completed module registration form to the Head of the Department of Industrial and Systems Engineering (DISE) who will approve/reject the registration in accordance with the stated prerequisites. 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 Portal. *Student On-line Services* allows 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

Please refer to the "Guide for Student Fees" (<http://web.up.ac.za/default.asp?ipkCategoryID=122>) which gives details regarding tuition fees and the payment thereof. Fees are revised annually and the fees for 2014 will be announced towards the end of 2013.

3.3.1 Initial payments at registration

An initial payment representing a first installment towards the payment of tuition fees, is payable before or during registration. It is permissible to pay the remainder of the tuition fees in two installments in a manner that will ensure that 50% of a student's fees account is settled by 30 April, and the account is paid in full by 31 July.

The initial payments towards tuition fees for postgraduate students in 2014 will be applicable:

- Postgraduate students who are registering for the first time for a particular field of study : R4600 for 2014;
- Postgraduate students who are renewing their registration for a masters dissertation or a PhD: R3000 for 2014;
- Postgraduate students who need to renew their registration in order to submit a dissertation/thesis for examination will, subject to the examination being completed before 31 March, be required to pay an administration levy of R800 for 2013. If the examination extends beyond 31 March the full re-registration fee of R3000 is payable.

3.3.2 Tuition fees

In 2013 the tuition fees for

- a 16 SAQA credit module amounted to R3 250;
- a Masters degree dissertation amounted to R25 590;
- The first year of registration for a PhD was R23 000;
- The second and any subsequent years of study for a research masters and PhD was a re-registration fee of R3 000.

The rate of inflation can be used as guideline to adjust the aforementioned fees and estimate the increased fees for 2014.

The student's registration must be renewed annually until such time as the degree requirements have been complied with. Candidates who fail to renew their registration or who interrupt their studies are liable for the full tuition fees when studies are resumed.

Or Students registering for a research masters or PhD are required to be registered without interruption. If an interruption in registration occurs, the fees for the first year of study will apply.

3.3.3 International students

Non-South African students are, for the duration of their studies, required to annually pay an international administration levy (R2 500 for 2014).

If an international student studies for a non-research based degree, the fees are in the majority of instances double those mentioned above.



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4. RESEARCH

The following section is applicable mainly to students enrolling for master's and doctoral 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.

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

- Forecasting
- Operations Research
- Simulation Modelling
- Stochastic Modelling
- Business Architecture
- Business Process Design
- Performance Measurement and Metrics
- Systems Integration
- Total Quality Management
- City Logistics and Urban Transport
- ICT and E-commerce Integration
- Integrated Supply Chain Processes and Systems
- Supply Chain Design and Engineering
- Value Chain Analysis and Optimisation

4.2. Submitting the Topic for Approval

All master's and PhD students must submit their research proposals to the Head of the DISE for approval. Each student needs to present their research proposal before registration. Colloquiums will be scheduled for all focus areas with the relevant lecturers after approval of the proposal. The Head of the DISE will be the chairperson for all the colloquiums.

4.2.1. Proposal Document

The document should include a complete project plan that addresses technical deliverables, time scales, and costs. A copy must be submitted to Miss Hanli Potgieter at hanli.potgieter@up.ac.za. It is recommended that students follow the guidelines proposed during the course *Research Methodology - INI 781*, a prescribed module at honours level since 2004. 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?



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- 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?

4.2.2. Presentation

For Masters candidates, each 30 minute session will consist of a 20 minute presentation by the prospective student, and time for discussions and questions by the committee and other research students. Doctoral candidates will have a 45 minute session, consisting of a 30 minute presentation, and the remaining time for discussions. Prospective students should confirm with the Department the availability of electronic media they may need for their presentation. The presentation should correspond with the written document handed in before the presentation. Once a proposal has been approved, the candidate will be informed in writing, from where the candidate should refer to the formal *Post-graduate research guidelines* S0001E03.

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 administration of the registration of the title is handled by the Faculty. After the Faculty has registered and approved the title, the student will receive a letter of confirmation from 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 nevertheless 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.

4.3. Deliverables

Details regarding the content and technical editing of the deliverables are contained in the Department of Industrial Engineering's *Quality Management System*, the *Post-graduate research guide*, document S0001E03.



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A. CONTACT DETAIL

A.1. Department of Industrial and Systems Engineering

Contact person	Miss Hanli Potgieter
Contact details	Tel: +27(0)12 420 5230 Fax: +27(0)12 362 5103 E-mail: hanli.potgieter@up.ac.za Web: http://www.up.ac.za/ie
Physical address	Room 3-13 Main Campus, University of Pretoria Engineering Building II c/o Lynnwood Rd and Roper St Pretoria
Postal address	Miss Hanli Potgieter Industrial and Systems Engineering University of Pretoria Pretoria 0002

A.2. Engineering Student Administration **BEng(Hons)(Industrial) / BSc(Hons)(Applied Science)(Industrial Systems)**

Contact person	Ms. Thabiso Motsei
Contact details	Tel: +27(0)12 420 6520 E-mail: thabiso.motsei@up.ac.za
Physical address	Student administration Engineering Building I, Room 6-9 Main Campus, University of Pretoria c/o Lynnwood Rd and Roper St Pretoria
Postal address	Ms. Thabiso Motsei Student administration School of Engineering University of Pretoria Pretoria 0002



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A.3. Engineering Administration

Hons Applications, MEng(Industrial) / MSc(Applied Science)(Industrial Systems) / Ph.D

Contact person/s	Ms. Nadine Ah Dong
Contact details	Tel: +27(0)12 420 3011 E-mail: Nadine.ahdong@up.ac.za
Physical address	Student administration Engineering Building I, Floor 6 Main Campus, University of Pretoria c/o Lynnwood Rd and Roper St Pretoria
Postal address	Ms Nadine Ah Dong Student administration School of Engineering University of Pretoria Pretoria 0002

A.4. Client Service Centre

Contact details	Tel: +27(0)12 420 3111 Fax: +27(0)12 420 4555 E-mail: csc@up.ac.za Web: http://web.up.ac.za/default.asp?ipkCategoryID=2520
Physical address	Client Service Center University of Pretoria main campus c/o Lynnwood Rd and Roper St Pretoria
Operating hours	Monday - Fridays 08:00 - 16:00



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B. MODULE DESCRIPTIONS

BAN 780 Industrial analysis 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English

Module content:

- Monte Carlo Simulation, Continuous Simulation and Discrete Simulation
- System Dynamics
- Multi-objective Decision-making
- Operations Research
- Decision Analysis

Only for BSc Hons Apl Sci students

BBA 781 Enterprise Architecture 781

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English

Module Content:

Enterprise Engineering is a developing discipline that aims to comprehend enterprise complexity and thereby master it (Hoogervorst, 2009). Two important concepts support enterprise engineering: *enterprise ontology and enterprise architecture*. While enterprise ontology describes the essence of an enterprise, enterprise architecture provides normative guidance for design (Hoogervorst, 2009). The course provides different approaches to describe/represent the enterprise (its essence and implemented versions) and guide its evolution.

The module covers:

- Background on Systems thinking, Systems Design and Systems Engineering
- Different perspectives on alignment: creating coherency and consistency between different systems
- Prominent approaches (and related mechanisms) to govern coherent and consistent enterprise design (e.g. Zachman, The Open Group, EA as Strategy, Hoogervorst/Dietz)
- Enterprise Modelling (notation standards, languages using different tools)
- Case studies
- Change Management

Prerequisites: Information systems design (BID 320) or similar course.

BCS 780 Novel Industrial and Systems engineering 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English

Module content:

The module affords an individual student the opportunity of studying a designated area of coherent advanced knowledge under the tutorship of a specialist staff member of the Department of Industrial and Systems Engineering.



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- The topic must be scoped with a senior member of staff
- The topic proposal must be submitted to the postgraduate committee for approval, along with a nomination for suitable (qualified) external examiner

BDE 780 Design and analysis of experiments 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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 deals with the following:

- 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

Prerequisites: 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.

BEE 780 Inventory modelling 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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 value of money, deterioration, time varying, stochastic inputs, imperfect quality, integrated scheduling and lot sizing models, service systems and retrieval queues)
- 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



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BES 780 Applied engineering statistics 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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 course covers the following topics:

- 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 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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 course covers the following topics:

- 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, On-line and Off-line 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

Prerequisites: BES 220 or equivalent as approved by the Head of the Department. Students who have completed another statistical module than BES 220 must apply for acceptance to BGH 780 by writing a letter which demonstrates equivalence of modules.

BHM 780 Probability models 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English



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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.

It 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, queueing and inventory models.

BIS 780 Information systems 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English

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.

It 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

Prerequisites: 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)

BLK 781 Supply Chain Processes 781

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English



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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.

Course outline:

- 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 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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.

The following topics are covered in the course: Standard Process Physics principles, facts and models. Process Intelligence. Adaptive process control and SMART processes. Robustness and complexity analysis. Process mining. Social Network Analysis 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. Prerequisites: Module only available to students with a BEng Industrial degree

BOZ 780 Operations research 780²

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English



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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 is not known.

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

BPZ 782 Manufacturing planning and control systems 782

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English

Module content:

To introduce the student to the manufacturing environment, the nature and scope of the manufacturing task, the manufacturing planning and control systems.

It covers:

- Production Management History, context and modelling complexity
- Understanding system variability and attendant buffering principles and techniques
- Batching principles and techniques (from EOQ to RoP)
- Production planning and control principles and activities
- Demand anticipation and management
- Sales and Operations planning, MPS and MRP
- Capacity planning, scheduling and production flow management
- Tactical and consequential inventory management principles
- Pull production philosophies and techniques
- Principles, the variability impact and effects on system slacks
- Theory of constraints, CONWIP and Lean/JIT
- Current PM challenges and research opportunities

BSI 780 Business Engineering 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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.

The following topics are covered in the course:

- BE principles for design, implementation and optimisation of complex business systems



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- 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.

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.

BTH 780 Reliability engineering 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English

Module content:

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

Capita Selecta from:

- Introduction to Reliability Engineering
- Reliability Mathematics
- Probability Plotting
- Reliability Prediction for Design
- Reliability Testing
- Reliability Growth
- Maintainability
- Reliability Management

BUY 780 Simulation modelling 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English

Module content:

- Stochastic Modelling. Stochastic Simulation Modelling
- System Dynamics. Agent Based Simulation
- Input/Output Analysis. Simulation and Optimization
- Simulation Project Management. Simulation Modelling Software

BVK 780 Supply chain design 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English



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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.

Course outline:

Supply Chain Network Design, Strategic Management of Inventory, Supply Chain Integration, Strategic Alliances Coordinated Product and Supply Chain Design, Supply Chain Modelling (SCOR, VRM)

Prerequisites: The module requires either BOB 310 and BLK 320 or BLK 780.

INI 781 Research methodology 781

Academic organisation: Graduate School of Technology Management

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

Language of instruction: English

Module content:

This course provides the student with sufficient knowledge and skills to undertake independent research for a masters' dissertation.

The course covers the following topics:

research philosophy in management research, the research proposal, the research management process, qualitative and quantitative research designs, literature reviews, data gathering techniques such as surveys and case studies, data analysis techniques such as descriptive and inferential statistics, hypotheses testing, writing the dissertation, journal articles and symposium papers.

BAO 780 Advanced aspects of Operations Research 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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.

BAR 780 Solution Algorithms in Operations Research 780¹

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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



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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.

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

BLC 780 Lean supply chain strategies and systems 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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.

Course 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

BCI 780 Supply chain information & decision technology 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or 2

Credits: 16

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



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C. Timetable

Subject	Contact	Time	First Semester 2014																								Venue	
			March (*BW 1)					May (*BW 2)					June (*BW 3 & Exams)															
			10	11	12	13	14	12	13	14	15	16	2	3	4	5	6	23	24	25	26	27						
*Industrial Analysis (BAN 780)	Prof Paul Kruger 012 460 7097	08:00 AM 13:00 PM	No Class																									BW 1&2: Eng II 4-30 BW 3 & June-Exam venue: Humanities Building 4-6
Supply Chain Processes (BLK 781)	Mr Max Smeiman 0824947694 / 0117052578	08:00 AM 13:00 PM																										BW 1&2: Eng II 4-30 BW 3 & June-Exam venue: Humanities Building 4-6
Enterprise Architecture (BBA 781)	Dr Mame de Vries 012 420 2038	08:00 AM 13:00 PM																										BW 1&2: Eng II 4-30 BW 3 & June-Exam venue: Humanities Building 4-6
Manufacturing Planning and Control Systems (BPZ 782)	Dr Olufemi Adetunji 012 420 5229	08:00 AM 13:00 PM																										BW 1&2: Eng II 4-30 BW 3 & June-Exam venue: Humanities Building 4-6
Design and Analysis of Experiments (BDE 780)	Mr Wynand Breytenbach 012 4202376	08:00 AM 13:00 PM																										BW1: Mond 10 Mrt Louw Hall Tues 11 Mrt Eng II 3-34 BW2: Mond 12 May Louw Hall Tues 13 May Eng II 3-40 BW 3 & June-Exam venue: Humanities Building 4-6
			Second Semester 2014																									
Subject	Contact	Time	August (*BW 1)					Sept / Oct (*BW 2)					November (*BW 3 & Exams)														Venue	
			18	19	20	21	22	29	30	1	2	3	10	11	12	13	14	24	25	26	27	28						
Operations Research (BOZ 780) ²	Prof Johan Joubert 012 420 2843	08:00 AM 13:00 PM																										BW 1,2 & 3: Eng II 4-30 Exam venues: Eng II 4-30 & Eng II 4-36
Quality Management (BGH 780)	Mr Wynand Breytenbach 012 4202376	08:00 AM 13:00 PM																										BW 1,2 & 3: Eng II 4-30 Exam venues: Eng II 4-30 & Eng II 4-36
Business Engineering (BSI 780)	Mr Elias Willemsse 012 420 3443	08:00 AM 13:00 PM																										BW 1,2 & 3: Eng II 4-30 Exam venues: Eng II 4-30 & Eng II 4-36
Solution Algorithms in Operations Research (BAR 780) ¹	Mr Elias Willemsse 012 420 3443	08:00 AM 13:00 PM																										BW 1,2 & 3: Eng II 4-30 Exam venues: Eng II 4-30 & Eng II 4-36
Supply Chain Design (BVK 780)	Mr Max Smeiman 0824947694 / 0117052578	08:00 AM 13:00 PM																										BW 1,2 & 3: Eng II 4-30 Exam venues: Eng II 4-30 & Eng II 4-36
*Research Methodology (INI 781)	Ms Marlene Mulder 012 420 4519	Lectures: 27-29 August Venue: Louw Hall. Exam: 09:00 - 12:00 24 Oct Venue: IT 2-27 and Louw Hall																										

* INI 781 Compulsory for all Hons students. * BAN 780 Compulsory for all Apl Sci Hons students. * 'BW' Refers to Block Week

Lectures

NOTE: * BW 2 Rescheduled due to election day on 7th May 2014. New Dates are: Mond 12 May - Frid 16 May 2014

NOTE: BDE 780 Classes had to be re-scheduled due to large student enrolment

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

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

Date: 2014/10/07

Signature:

Prof. VSS Yadavalli

Head: Department of Industrial and Systems Engineering

Exams



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D. Frequently asked questions

- **What are typical costs for graduate studies?**

Refer to 3.3. University fees for postgraduate studies are covered on the University website. Navigate from the main webpage at <http://www.up.ac.za> to Prospective Postgraduate Students. From this page there are links to fees, bursaries and loan information.

- **Which electives may be taken outside the Department?**

Although not a fully comprehensive list, the following subjects may be considered since students have registered for these subjects in the past. Students should consult the relevant Department to confirm whether the subjects will be presented, and whether they will be allowed to enroll for the specific subjects.

Department	Subject	Code	
Computer Science *Engineering and Technology Management	Artificial Intelligence in Planning and Control	AIP 780	
	Decision Analysis	IBD 780	
	Engineering Economics	IKN 780	
	Engineering Logistics	IIX 780	
	Maintenance Management	IMC 780	
	Operations Management	IVV 781	
	Project Management	IPK 780	
	Quality Management	IKK 780	
	Systems Engineering	ISE 780	
	Technological Entrepreneurship	IEE 780	
	Technology & Innovation Management	ITI 780	
	Information Science	Competitive Intelligence (I&II)	INY 726 & INY 727
		Information and Knowledge Management (I&II)	INY 713 & INY 716
Mathematics	Mathematical models for Financial Engineering	WTW 732	
	Mathematical models for Financial Engineering	WTW 762	
Mechanical Engineering	Numerical methods and optimization	MNO 732	

*Applicable to courses offered by the Department of Engineering and Technology Management:

Each course is offered by way of two and a half consecutive days of full-time attendance. Class attendance is compulsory and important. Distance support is provided via the Internet (*ClickUP*) and complements the contact in the classroom. For this reason, all students are required to have access to the Internet through a suitable browser and be able to take part in discussions using the Internet. A CD with all the relevant information/study material needs to be obtained from Marlene Mulder. As some of the lecturers will set a test during the lecture days or require that an assignment be submitted, it is necessary to obtain the CD, and access *ClickUP* before the lecture days to allow for the necessary study/preparation time.

The closing date for registration for these courses is 4 to 7 weeks before the lecture days for the specific course. Kindly contact Marlene Mulder at marlene.mulder@up.ac.za for the timetable and detail with regard to registration.

- **Are there bursaries or other financing available?**

The following sources may be consulted for bursary and financing options:

- Financing for prospective students, available at <https://www.up.ac.za>. Follow these links: University of Pretoria Home, New Students and Financial Information.
- Notice board at the entrance of the Department of Industrial and Systems Engineering