University of Pretoria Yearbook 2023

BScHons (Applied Science) (Industrial Systems) (12243002)

Department	Industrial and Systems Engineering
Minimum duration of study	1 year
Total credits	128
NQF level	08

Programme information

The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits.

The degree is awarded on the basis of examinations only.

The BScHons (Applied Science) degree is conferred by the following academic departments:

- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the relevant head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

Admission requirements

1. Three-year BSc (or equivalent) degree (in Natural Sciences)
   with a cumulative weighted average of at least 60% for the degree
   or
   relevant BTech qualification excluding the National Diploma; i.e. one offered by a department of civil engineering at a university of technology in South Africa
   with a cumulative weighted average of at least 75% for the degree
   and
   no modules failed in the BTech degree
   or
   a relevant Advanced Diploma qualification (NQF Level 7), excluding the National Diploma; i.e. one offered by a department of industrial engineering at a university of technology in South Africa

with a cumulative weighted average of at least 70% for the diploma
and
no modules failed in the Advanced Diploma
or
a four-year engineering-based university degree not recognised by ECSA for registration as a professional engineer
or
BEng degree awarded by the University of Pretoria
or
relevant four-year bachelor's degree in engineering that the Engineering Council of South Africa (ECSA) regards as acceptable for registration as a candidate engineer and for eventual registration as a professional engineer

2. An entrance examination may be required
3. Comprehensive intellectual CV

Other programme-specific information

The programme consists of two compulsory modules (48 credits) with any relevant core module as prerequisite and the remainder of credits either core and/or elective modules. Students are allowed 16 relevant credits from outside the department. Students are advised to select modules in line with their desired research stream:

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

Please refer to the Programme Guide for further information, available here.

Examinations and pass requirements

Refer also to G18 and G26.

i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. G18(1) applies with the understanding that under exceptional circumstances an extension of a maximum of three years may be approved: provided that the Dean, on reccommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with distinction

A student passes with distinction if he or she obtains a weighted average of at least 75% (not rounded) in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously). The degree must be completed within the prescribed study period.

General information

University of Pretoria Programme Qualification Mix (PQM) verification project

The higher education sector has undergone an extensive alignment to the Higher Education Qualification Sub-Framework (HEQF) across all institutions in South Africa. In order to comply with the HEQSF, all institutions are legally required to participate in a national initiative led by regulatory bodies such as the Department of Higher Education and Training (DHET), the Council on Higher Education (CHE), and the South African Qualifications Authority (SAQA). The University of Pretoria is presently engaged in an ongoing effort to align its qualifications and programmes with the HEQSF criteria. Current and prospective students should take note that changes to UP qualification and programme names, may occur as a result of the HEQSF initiative. Students are advised to contact their faculties if they have any questions.

Curriculum: Final year

Minimum credits: 128

BCS 780 and BAN 780 are compulsory modules.

Core modules

Industrial analysis 780 (BAN 780)

Module credits	16.00
NQF Level	08
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Not for Industrial Engineering students
Contact time	24 contact hours per semester
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1 or Semester 2

Module content

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

Enterprise engineering and research methods 781 (BBA 781)

Module credits	32.00
NQF Level	08
Prerequisites	Information Systems Design (BID 320) or similar course
Contact time	36 contact hours per semester
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1

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

Industrial and systems engineering research 780 (BCS 780)

Module credits	32.00
NQF Level	08
Prerequisites	Any one of the following modules: BAR 780,BBA 781,BGH 780,BLK 781,BOZ 780,BPZ 782,BUY 780,BVK 780
Contact time	36 contact hours per semester
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1 or Semester 2

Module content

*This is a compulsory research module.

The module affords an individual student the opportunity of studying a designated area of coherent advanced 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.

Supply chain processes 781 (BLK 781)

Module credits	16.00
NQF Level	08
Prerequisites	No prerequisites.

Contact time	24 contact hours
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1 or Semester 2

Module content

A key objective of supply chain management is to develop competiveness 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 and 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

Operations research 780 (BOZ 780)

Module credits	32.00
NQF Level	08
Prerequisites	BAN 313 or BAN 780
Contact time	36 contact hours per semester
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1 or Semester 2

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.

Manufacturing planning systems 782 (BPZ 782)

Module credits	32.00
NQF Level	08
Prerequisites	Operations Management and Operations Research (advisable but not mandatorily required)
Contact time	36 contact hours per semester
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1 or Semester 2

Module content

1. Review of the general framework for the planning and control of manufacturing and service systems
2. Deterministic Lot Sizing Models of Inventory Management
   a. Basic single item EOQ/EPQ, shortage, all unit and marginal discount models
   b. Discrete time and quantity models and their solution approaches
   c. Multi item models including shared resource with constraints, common cycle, basic cycle, power of two and Economic Lot Scheduling models
   d. Multi echelon and foundational supply chain inventory models
   e. Models with building blocks for contemporary research areas in deterministic inventory models: deterioration, non-linear demand rate, non-linear production rate, growing items, demand-, time-, stock and price- dependent models and other emerging model block areas
3. Finite Job Scheduling Models and their Solution Techniques
   a. Scheduling notation, dispatch rules and their solution characteristics
   b. Flow shop models, job shop models, selected variants and their solution algorithms
   c. Formulation of basic mathematical programming models for scheduling problems
   d. Solution techniques for scheduling LP models and analysis of solution heuristics: review of general mathematical proof techniques; growth functions and asymptotic bounds of solution algorithms; NPcompleteness, orst- and average-case behaviour of algorithms and illustration with some basic problems; analysis of selected exact scheduling solution algorithms; discussion of selected heuristic and meta heuristic alternatives and their time complexity; design and analysis of hybrid-solutions for NP-hard scheduling problems; scheduling solution/result analysis
4. Structural Models of Supply Chain Factors and their Relationships
   a. Review of descriptive statistics, statistical inference, estimation and hypothesis testing principles
   b. Multivariate statistical problems and foundational regression analysis
   c. Foundations of Structural Equation Modelling (SEM) and its representations
   d. Foundational Principal Component Analysis (PCA) and Factor Analysis (FA)
   e. Introduction to Covariance Based (CB) and Partial Least Square (PLS) SEM approaches
   f. Procedure for implementing PLS SEM and interpretation of solution output
   g. Cases of Supply Chain SEM models and their analysis with PLS SEM using Smart PLS

Simulation modelling 780 (BUY 780)

Module credits	32.00
NQF Level	08
Prerequisites	BAN 313 or BAN 780
Contact time	36 contact hours per semester
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1 or Semester 2

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.

Supply chain design 780 (BVK 780)

Module credits	16.00
NQF Level	08
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 2

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)

Elective modules

Reliability engineering 780 (BTH 780)

Module credits	16.00
NQF Level	08
Prerequisites	No prerequisites.
Contact time	24 contact hours
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1 or Semester 2

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

Regulations and rules

The regulations and rules for the degrees published here are subject to change and may be amended after the publication of this information.

The General Academic Regulations (G Regulations) and General Student Rules apply to all faculties and registered students of the University, as well as all prospective students who have accepted an offer of a place at the University of Pretoria. On registering for a programme, the student bears the responsibility of ensuring that they familiarise themselves with the General Academic Regulations applicable to their registration, as well as the relevant faculty-specific and programme-specific regulations and information as stipulated in the relevant yearbook. Ignorance concerning these regulations will not be accepted as an excuse for any transgression, or basis for an exception to any of the aforementioned regulations.

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