University of Pretoria Yearbook 2021

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** 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.

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

Review of MPC, Agile Manufacturing Processes, Models of MPC
Section 1: Review of MPC Theories and Framework
Section 2: Research Framework for Problems in Manufacturing Systems
1. Mathematical Model based Problems and their techniques
2. Estimation and Hypothesis based Problems and their techniques
Section 3: Introduction to MPC Problems and sample Models
1. Forecasting models
2. Aggregate planning models
3. Lot sizing and disaggregation models
4. Finite Scheduling models
5. Lean Manufacturing Models
6. Basic Distribution and Replenishment Models
7. Basic Supply Chain Structural Analysis and Performance Models
Section 4: Agile Panning Problems and Techniques
1. Multi-Level Master Scheduling Techniques
2. Constraint Scheduling – (TOC theory, applications and optimisation)
3. Lean Manufacturing Implementation (from Flow Lean to Process Kaizen)
4. Introduction to CONWIP ideology
5. Introduction to Demand Driven MRP

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

The information published here is subject to change and may be amended after the publication of this information. The General Regulations (G Regulations) apply to all faculties of the University of Pretoria. It is expected of students to familiarise themselves well with these regulations as well as with the information contained in the General Rules section. Ignorance concerning these regulations and rules will not be accepted as an excuse for any transgression.