

NATIONAL DIPLOMA: INFORMATION TECHNOLOGY: INTELLIGENT INDUSTRIAL SYSTEMS (Extended curriculum programme with foundation provision) Qualification code: NDIIF1 - NQF Level 6

Campus where offered: Soshanguve South Campus

Important notification to new applicants:

No new applications will be accepted as from 2020. Students who enrolled for this qualification for the first time in 2017 (or thereafter), should note that it will not be possible to continue with any Baccalaureus Technologiae as from 2020, since it is being replaced by qualifications aligned with the newly-implemented Higher Education Qualification Sub-Framework. Potential students are advised to consult the University's website for any new qualifications which might not be published in this Prospectus.

REMARKS

- a. *Admission requirement(s) and selection criteria:*
See qualification NDITF1 listed under the ICT First Years' and Foundation Unit.
- b. *Minimum duration:*
Four years, divided as follows:
 - Year one: foundation subjects.
 - Year two: general first-year subjects.
 - Years three and four: specialisation subjects.
- c. *Presentation:*
Day classes.
- d. *Intake for the qualification:*
January only.
- e. *Exclusion and readmission:*
See Chapter 2 of Students' Rules and Regulations.
- f. *Recognition of Prior Learning (RPL), equivalence and status:*
See Chapter 30 of Students' Rules and Regulations.
- g. *Industry Exposure III B (Work-Integrated Learning):*
Students may register for this subject only with the permission of the Head of Department. See Chapter 5 of Students' Rules and Regulations (paragraphs 5.2 and 5.3).
- h. *Subject credits:*
Subject credits are shown in brackets after each subject.

Key to asterisks:

- * Information does not correspond to information in Report 151.
(Deviations approved by the Senex of 31 July 2012.)

CURRICULUM

Please note that students will register for all first- and second-year subjects under qualification code NDITF1.

FIRST YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
------	---------	--------	-------------------------

FIRST SEMESTER

FPALS01	Foundation Academic and Language Skills	(0,125)	
---------	---	---------	--



FPITM01 Foundation ICT Mathematical Skills (0,125)

TOTAL CREDITS FOR THE SEMESTER: 0,250

SECOND SEMESTER

FPIDS01 Foundation Information and Software Development Skills (0,125)

FPPRS01 Foundation Presentation and Reporting Skills (0,125)

TOTAL CREDITS FOR THE SEMESTER: 0,250

TOTAL CREDITS FOR THE FIRST YEAR: **0,500**

SECOND YEAR

After completion of all first-year subjects.

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
------	---------	--------	-------------------------

FIRST SEMESTER

CFS10AT Computing Fundamentals IA (0,062)

CGS10AT Computing Systems IA (0,062)

CMK10AT Computing Skills IA (0,063)

DSO17AT Development Software IA (0,063)

TOTAL CREDITS FOR THE SEMESTER: 0,250

SECOND SEMESTER

CFS10BT Computing Fundamentals IB (0,062)

CGS10BT Computing Systems IB (0,062)

CMK10BT Computing Skills IB (0,063)

DSO17BT Development Software IB (0,063) Development Software IA

TOTAL CREDITS FOR THE SEMESTER: 0,250

TOTAL CREDITS FOR THE SECOND YEAR: **0,500**

As from the third year, a student will register for the specialisation field: Intelligent Industrial Systems (NDIIF1).

THIRD YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
------	---------	--------	-------------------------

FIRST SEMESTER

GPM20AT Games Programming IIA (0,078)* Development Software IB

IIE20AT IT Electronics IIA (0,078)*

IIS20AT Intelligent Industrial Systems IIA (0,075)* Computing Systems IB

ITT10AT IT Mathematics IA* (0,094)*

TPG111T Technical Programming I (0,250) Development Software IB

TOTAL CREDITS FOR THE SEMESTER: 0,575

SECOND SEMESTER

GPM20BT Games Programming IIB (0,078)* Games Programming IIA

IIE20BT IT Electronics IIB (0,078)* IT Electronics IIA



IIS20BT	Intelligent Industrial Systems IIB	(0,075)*	Intelligent Industrial Systems IIA
ITT10BT	IT Mathematics IB*	(0,094)*	IT Mathematics IA
TPG201T	Technical Programming II	(0,250)	Technical Programming I
TOTAL CREDITS FOR THE SEMESTER:		0,575	
TOTAL CREDITS FOR THE THIRD YEAR:		1,150	

FOURTH YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FIRST SEMESTER			
DIC101T	Discrete Structures I*	(0,100)	
IDC30AT	Industry Exposure IIIA	(0,125)	
IIE30AT	IT Electronics IIIA	(0,125)	Intelligent Industrial Systems IIB IT Electronics IIB
IIE30BT	IT Electronics IIIB	(0,125)	Intelligent Industrial Systems IIB IT Electronics IIB
IIS301T	Intelligent Industrial Systems III	(0,250)	Intelligent Industrial Systems IIB IT Electronics IIB
TOTAL CREDITS FOR THE SEMESTER:		0,725	

SECOND SEMESTER

On completion of all the above subjects. Students with only one subject outstanding may be allowed to register for that subject and Industry Exposure IIIB with the approval of the Head of Department.

IDC30BI	Industry Exposure IIIB	(0,125)	
TOTAL CREDITS FOR THE SEMESTER:		0,125	
TOTAL CREDITS FOR THE FOURTH YEAR:		0,850	
TOTAL CREDITS FOR THE QUALIFICATION:		3,000	

SUBJECT INFORMATION (OVERVIEW OF SYLLABUS)

The syllabus content is subject to change to accommodate industry changes. Please note that a more detailed syllabus is available at the Department or in the study guide that is applicable to a particular subject. On 02 August 2018, the syllabus content was defined as follows:

C

COMPUTING FUNDAMENTALS IA (CFS10AT)

1 X 3-HOUR PAPER

(Subject custodian: Department of Computer Science)

The student is introduced to the fundamentals of computers and information systems, computer organisation and data processing. (Total tuition time: ± 90 hours)

COMPUTING FUNDAMENTALS IB (CFS10BT)

1 X 3-HOUR PAPER

(Subject custodian: Department of Computer Science)

The basic concepts of system development, data management, management information systems, ethics, privacy and security, purchasing and maintaining microcomputers, number systems and binary logic. (Total tuition time: ± 54 hours)



COMPUTING SKILLS IA (CMK10AT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Informatics)**

This subject aims to equip the student with fundamentals of IT Soft skills for both the ICT industry and other working environments upon which a successful career can be built. In addition, it will also improve the student's relation and interaction abilities needed within the dynamic ICT industry. The student who successfully completes this subject must identify and implement various thinking skills and learning styles, state the legal and cultural sensitivity issues of IT, identify and explain the variety of soft skills including study skills and strategies, research, presentation as well as communication skills, and identify and explain interpersonal skills in relation to character, time management and team building dynamics and conflict resolution. (Total tuition time: ± 60 hours)

COMPUTING SKILLS IB (CMK10BT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Informatics)**

The aim of this subject is to extend the skills in CMK10 AT so as to improve on student's relations and interaction capabilities that will be applicable within the dynamic ICT industry and the external environment. The student who successfully completes this subject must describe, distinguish and portray changes in terms of personality profiles, emotional intelligence, self-management, stress management and relationship management; identify and apply the notion of team dynamics; deal with conflict and understand the dynamics behind change; report on effective correspondence; produce meeting documents; conduct meetings; and demonstrate the required communication skills to develop interpersonal business relationships through by means of group work. (Total tuition time: ± 60 hours)

COMPUTING SYSTEMS IA (CGS10AT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

Introduction to hardware, operating systems, motherboards, processors, memory, hard drives, installing and supporting I/O devices, multimedia devices and mass storage, PC maintenance and troubleshooting strategies, and installing and maintenance of Windows. (Total tuition time: ± 54 hours)

COMPUTING SYSTEMS IB (CGS10BT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Information Technology)**

Provides the foundation of data communications and local area management, OSI model and/or TCP/IP protocol stack model, data transmission principles, media, major protocols, topologies, routing methods, introduction to networking principles and network operating system fundamentals. (Total tuition time: ± 54 hours)

D**DEVELOPMENT SOFTWARE IA (DSO17AT)****1 X 4-HOUR COMPUTER-BASED****(Subject custodian: Department of Computer Science)**

Aim: To learn to solve problems using the basic programming principles, and then practically apply that knowledge in C++. Objectives: To enable the student to understand problems and know how to solve them by using a computer; understand the general concepts and arithmetic used in programming, sequence, selection and iteration control structures and a variety of built-in data types, including strings. The students are exposed to the concept of event-driven programming in a visual programming environment focusing on the development of graphical user interfaces to solve real-life practical programming problems. (Total tuition time: ± 72 hours)

DEVELOPMENT SOFTWARE IB (DSO17BT)**1 X 4-HOUR COMPUTER-BASED****(Subject custodian: Department of Computer Science)**

Aim: To expand on the already mastered knowledge obtained in Development Software IA. Objectives: To broaden the programming skills base of the student by adding the following topics: write an algorithm and applying it in VB.NET/C++ using functions and sub-procedures, and write an algorithm containing one-dimensional arrays. String manipulation will be continued as well as a brief introduction to text file processing. (Total tuition time: ± 72 hours)

DISCRETE STRUCTURES I (DIC101T)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

Review of functions, relations and sets. Review of proposition and predicate logic. Methods of theorem proving, strong and weak induction, finite and infinite sets, set operations, introduction to computational complexity, theta and big-O notation. Combinatorics, including permutations and combinations. Graphs and trees, discrete probability and binomial distribution. (Total tuition time: ± 90 hours)



F**FOUNDATION ACADEMIC AND LANGUAGE SKILLS (FPALS01) 1 X 3-HOUR PAPER**
(Subject custodian: ICT First Years' and Foundation Unit)

Aim/Purpose: To provide a sound foundation for, and to enhance basic language proficiency and academic skills necessary for reading, writing and studying in an ICT environment. **Objectives:** Analyse, adjust and improve study skills. Apply research skills in assignments. Interpret and reflect on all available and relevant resource material in proper English. Communicate in a comprehensible and clear manner in both a general and subject-specific manner showing cultural sensitivity. Demonstrate intermediate-level proficiency in oral and written English. **Key topics:** Managing adjustment problems: student life, coping with diversity and change, time management, setting goals and note taking, summarising techniques, English vocabulary and grammar, reading and writing skills. (Total tuition time: ± 84 hours)

FOUNDATIONAL ICT MATHEMATICAL SKILLS (FPITM01) 1 X 3-HOUR PAPER
(Subject custodian: ICT First Years' and Foundation Unit)

Aim/Purpose: The focus of the subject is to ensure students have the necessary mathematical and numeracy skills needed for ICT. Students will also be introduced to abstract logical reasoning and computational thinking skills. These skills are further developed through practical exercises relating to various day-to-day problem-solving activities. **Objectives:** To develop the problem solving skills as well as the computational thinking skills of the student and therefore prepare the student for the programming subjects to follow. **Key topics:** The number system and basic arithmetic; introduction to algebra: expressions and equations; fractions and decimals, algebraic fractions; percentages; ratio and rate; perimeter, area and volume; measuring systems and units; time, distance and speed; Cartesian plane and coordinates; algebraic functions; matrices. (Total tuition time: ± 96 hours)

FOUNDATION INFORMATION AND SOFTWARE DEVELOPMENT SKILLS (FPIDS01) 1 X 3-HOUR PAPER
(Subject custodian: ICT First Years' and Foundation Unit)

Aim/Purpose: To prepare students for computer programming by developing logical, critical and lateral thinking skills. **Objectives:** To develop the students' logical thinking and problem-solving skills as preparation for programming. Abstract logical reasoning and computational thinking skills will therefore be used to solve problems. **Key topics:** Brain teasers as introduction to problem-solving; analysis and solving of word problems; solving of various day-to-day problems; introduction to algorithmic problem solving - sequence, basic selection, basic repetition steps; statistics; financial matters. (Total tuition time: ± 96 hours)

FOUNDATION PRESENTATION AND REPORTING SKILLS (FPPRS01) 1 X 3-HOUR PAPER
(Subject custodian: ICT First Years' and Foundation Unit)

Aim/Purpose: To provide a sound foundation for, and to enhance basic language proficiency skills necessary for reading and writing in an ICT environment with specific reference to presentations and reports. **Objectives:** Preparation of effective and professional reports and PowerPoint presentations. Interpret, relate and reflect on all available and relevant resource material in proper English. Communicate orally in a comprehensible and clear manner specifically when presenting various IT topics, demonstrate intermediate-level proficiency in written English. **Key topics:** Conflict management; problem solving; interpersonal relationships; stress management; communication theory; listening skills; public speaking and presentation skills; and report writing. (Total tuition time: ± 84 hours)

G**GAMES PROGRAMMING IIA (GPM20AT) 1 X 3-HOUR PAPER**
(Subject custodian: Department of Computer Systems Engineering)

Students are introduced to games programming techniques and learn how to apply them practically. The emphasis is placed on the design and integration of artificial intelligence engineering for the purpose of controlling virtual-world objects. (Total tuition time: ± 80 hours)

GAMES PROGRAMMING IIB (GPM20BT) 1 X 3-HOUR PAPER
(Subject custodian: Department of Computer Systems Engineering)

Advanced games programming techniques are applied practically. The application of concepts such as 3D graphics and network synchronisation is explored. The focus is on 3D virtual-world object AI manipulation and more advanced AI techniques. (Total tuition time: ± 80 hours)



INDUSTRY EXPOSURE IIIA (IDC30AT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Informatics)**

This subject enables students to gain insight to organisational characteristics and behaviour, personal and technological entrepreneurship; other issues include ethical and professional conduct in the workplace. The subject will also increase their knowledge of individual behavioural aspects, namely biographical characteristics, values attitudes, job satisfaction and personality and emotions, perceptions and individual decision making; broaden their understanding of the administrative structures of organisations, bureaucratic behaviour in global and diverse context; and develop interpersonal skills in applying and integrating contemporary theories of motivation. (Tuition time: ± 60 hours)

INDUSTRY EXPOSURE IIIB (IDC30BI)**CONTINUOUS ASSESSMENT****(Subject custodian: Department of Computer Systems Engineering)**

Industry Exposure IIIB is career-orientated and is aimed at integrating academic training with practical skills, as demanded by industry. Students work in industry for six months. (No formal tuition)

INTELLIGENT INDUSTRIAL SYSTEMS IIA (IIS20AT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

A study of system software assembly language and practical projects, using the printer port as PLC. (Total tuition time: ± 80 hours)

INTELLIGENT INDUSTRIAL SYSTEMS IIB (IIS20BT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

A more detailed study of the factory process to determine the controls regarding efficiency and safety of the environment that will have to be placed in the process. (Total tuition time: ± 20 hours)

INTELLIGENT INDUSTRIAL SYSTEMS III (IIS301T)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

Students are introduced to the world of mobile robotics by implementing behaviour-based concepts to control an autonomous vehicle. (Total tuition time: ± 80 hours)

IT ELECTRONICS IIA (IIE20AT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

Basic components of digital circuits, such as NOT, AND and OR gates. The more complex gate and logic functions are built by using these basic components. Boolean algebra and Karnaugh maps are used to simplify functions. Combination logic circuits, including adders, multi-vibrators, comparators, decoders, encoders, multiplexers and de-multiplexers, are discussed. Binary, octal, decimal and hexadecimal number systems are included. Theoretical presentations are supported by practical experiments in a laboratory. (Total tuition time: ± 80 hours)

IT ELECTRONICS IIB (IIE20BT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

Basic components of sequential circuits, namely latches and flip-flops. More complex memory components, such as adders and registers, are derived from the basic components. Different analogue-to-digital and digital-to-analogue converters are discussed. In the introduction to microprocessor systems, the central processor, memory, ports and interrupts are dealt with. (Total tuition time: ± 80 hours)

IT ELECTRONICS IIIA (IIE30AT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

The student should show a conceptual understanding of microcomputer systems, including microprocessors, microcomputers, microcontrollers and the MCS-51 family. Memory devices and design. Microcomputer programming. The MCS-51 instruction set, the use of serial and parallel ports, interrupts and timers (counters). The student should be able to perform a variety of tasks relating to the theoretical aspect of the subject, such as operating equipment, programming the 8031 and representing findings in a report. (Total tuition time: ± 80 hours)

IT ELECTRONICS IIIB (IIE30BT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

The development of logic circuits using VHDL. The student is guided through the complete design cycle of a logic circuit using the prescribed development environment. This involves the development of the logic circuit in VHDL and the implementation onto target hardware. The development of software consists of problem setting, state diagrams, timing diagram analysis and the writing of the VHDL. The next phase is the simulation of the program. The final phase consists of the downloading onto silicon and de-bugging of the software. (Total tuition time: ± 80 hours)



IT MATHEMATICS IA (ITT10AT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Mathematics and Statistics)**

Basic mathematics. Differentiation. Integration. Matrices and determinants. Vectors. Data handling. Complex numbers or mensuration. (Total tuition time: ± 90 hours)

IT MATHEMATICS IB (ITT10BT)**1 X 3-HOUR PAPER****(Subject custodian: Department of Mathematics and Statistics)**

Revision of differentiation (Mathematics I). Differentiation of functions with more than one variable. Further integration. Numerical methods. First-order ordinary differential equations. Matrices (Gauss elimination). (Total tuition time: ± 90 hours)

T**TECHNICAL PROGRAMMING I (TPG111T)****1 X 4-HOUR COMPUTER-BASED****(Subject custodian: Department of Computer Science)**

Aim: To introduce students to object-orientated concepts and principles using the C++ programming language. Objectives: Students must be able to create programs that are in accordance with Object-Orientated Programming (OOP) principles, use their own and pre-defined classes in programs, use structures such as control and interactive, use iterative statements in a program, manipulate strings and characters in a program, use arrays in a program, use inheritance, polymorphism and exception handling mechanisms, and understand graphical user interface design. Key topics: Classes, methods, objects, selection structures, loops, strings, arrays, file manipulations, inheritance, polymorphism, exception handling. (Total tuition time: ± 140 hours)

TECHNICAL PROGRAMMING II (TPG201T)**1 X 4-HOUR COMPUTER-BASED****(Subject custodian: Department of Computer Science)**

Aim/Purpose: The student is introduced to a modern rapid application development tool for Win32. with the purpose of solving every day programming challenges. Analyse and design. Objectives: Analyse and design software solutions to industry related information technology problems, utilise the required technical skills to effectively implement the designed solutions in a distributed IT environment. Key topics: Advanced OOP, C#, dynamic object instantiation, event-driven programming, back-end classes, strategic solution planning, systematic programme design, flat file data handling. Relational database application development, defensive programming, SQL implementation, triggers, events, implementation of data structures, advanced methods in data aware application development. (Total tuition time: ± 80 hours)

