

# NATIONAL DIPLOMA: INFORMATION TECHNOLOGY: INTELLIGENT INDUSTRIAL SYSTEMS

Qualification code: NDII12 - NQF Level 6

Campus where offered: Soshanguve South Campus (day classes offered during the week and on Saturdays)  
Last year of new intake: 2019  
Teach-out (phase-out) date: 31 December 2023

Students registered for this qualification should complete their studies according to the teach-out date prescribed for the qualification, subject to the stipulations of Regulation 3.1.11 and 3.1.13 in the Students' Rules and Regulations.

Information on phased-out programmes can be obtained from the TUT website, [www.tut.ac.za](http://www.tut.ac.za).

Key to asterisks:

\* Information does not correspond to information in Report 151.  
(Deviations approved by the Senex of 22 June 2011 and 31 July 2012.)

## CURRICULUM

Consult the 2019 Faculty Prospectus for the full contents of the qualification.

### FIRST YEAR

Please note that students will register for all first-year subjects under qualification code NDIT12, where they will be introduced to the basic principles of computers and information technology skills.

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
<b>FIRST SEMESTER</b>			
CFS10AT	Computing Fundamentals IA*	(0,125)	
CGS10AT	Computing Systems IA*	(0,125)	
CMK10AT	Computing Skills IA*	(0,125)	
DSO17AT	Development Software IA	(0,125)	
TOTAL CREDITS FOR THE SEMESTER:		0,500	
<b>SECOND SEMESTER</b>			
CFS10BT	Computing Fundamentals IB*	(0,125)	
CGS10BT	Computing Systems IB*	(0,125)	
CMK10BT	Computing Skills IB*	(0,125)	
DSO17BT	Development Software IB	(0,125)	Development Software IA
TOTAL CREDITS FOR THE SEMESTER:		0,500	
TOTAL CREDITS FOR THE FIRST YEAR:		<b>1,000</b>	

### SECOND YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
<b>FIRST SEMESTER</b>			
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 SECOND YEAR: 1,150

## THIRD YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
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### 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)	
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TOTAL CREDITS FOR THE SEMESTER: 0,125

TOTAL CREDITS FOR THE THIRD 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. At time of publication, the syllabus content was defined as follows:

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**COMPUTING FUNDAMENTALS IA (CFS10AT) 1 X 3-HOUR PAPER**  
(Subject custodian: End User Computing Unit)

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: End User Computing Unit)

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)



**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)

**I****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)

