NATIONAL DIPLOMA: ENGINEERING: COMPUTER SYSTEMS
Qualification code: NDCY03 - 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 Potential students are advised to consult the University's website for any new qualifications which might not be published in this Prospectus.

Generic outcomes of the National Diploma: Engineering:

- **Exit Level Outcome 1: Problem solving**
  Apply engineering principles to systematically diagnose and solve well-defined computer systems engineering problems.
- **Exit Level Outcome 2: Application of scientific and engineering knowledge**
  Apply knowledge of mathematics, natural science and engineering sciences to applied engineering procedures, processes, systems and methodologies to solve well-defined computer systems engineering problems.
- **Exit Level Outcome 3: Engineering design**
  Perform procedural design of components, systems, works, products or processes to meet desired needs normally within applicable standards, codes of practice and legislation.
- **Exit Level Outcome 4: Investigation**
  Conduct investigations of well-defined problems through locating and searching relevant codes and catalogues, schematics and data books, conducting standard tests, experiments and measurements.
- **Exit Level Outcome 5: Engineering methods, skills, tools, including information technology**
  Use appropriate techniques, resources, and modern engineering tools, including information technology for the solution of well-defined computer systems engineering problems, with an awareness of the limitations, restrictions, premises, assumptions and constraints.
- **Exit Level Outcome 6: Professional and technical communication**
  Communicate effectively, both orally and in writing within an engineering context and with varying audiences.
- **Exit Level Outcome 7: Impact of engineering activity**
  Demonstrate knowledge and understanding of the impact of computer systems engineering activity on the society, health and safety, economy, industrial and physical environment, and address issues by defined procedures.
- **Exit Level Outcome 8: Individual and teamwork**
  Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member and leader in a technical team and to manage projects.
- **Exit Level Outcome 9: Independent learning**
  Engage in independent and life-long learning through well-developed learning skills. Understand and commit to professional ethics, responsibilities and norms of computer systems engineering technical practice.
- **Exit Level Outcome 10: Engineering professionalism**
  Demonstrate an understanding of workplace practices to solve computer systems engineering problems consistent with academic learning achieved.

REMARKS

a. *Admission requirement(s) and selection criteria:*

- **FOR APPLICANTS WHO OBTAINED A SENIOR CERTIFICATE BEFORE 2008:**

  Admission requirement(s):
  A Senior Certificate or an equivalent qualification with a pass in English, and at least 50% at Higher Grade or at least 60% at Standard Grade for Mathematics and Physical Science.

Applicants with a Senior Certificate or an equivalent qualification with a pass in English and at least 40% at Higher Grade or at least 50% at Standard Grade for Mathematics and Physical Science (or any relevant subject considered by the Department/Faculty) and a pass in English will be considered for admission to the extended programme only.

Recommended subject(s):
Computer Studies.

- **FOR APPLICANTS WHO OBTAINED A NATIONAL SENIOR CERTIFICATE IN OR AFTER 2008:**

Admission requirement(s):
A National Senior Certificate with a bachelor's degree or a diploma endorsement, or an equivalent qualification, with an achievement level of at least 4 for English (home language or first additional language) and 4 for Mathematics and 4 for Physical Sciences or an equivalent relevant subject considered by the Department/Faculty.

Applicants with a National Senior Certificate with a bachelor's degree or diploma endorsement, or an equivalent qualification with at least 4 for English (first additional language) or at least 3 for English (home language) and 3 for Mathematics and 3 for Physical Sciences or an equivalent relevant subject considered by the Department/Faculty will be considered for admission to the extended programme only.

Recommended subject(s):
None.

Selection criteria:
To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **24**. Applicants with an APS of at least **20** will be considered for the extended programme.

- **APPLICANTS WHO OBTAINED A QUALIFICATION FROM TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) COLLEGES (PREVIOUSLY KNOWN AS FET COLLEGES):**

Applicants with a National Certificate (Vocational) at NQF Level 4:

Admission requirement(s):
A National Certificate (Vocational) at NQF level 4 with bachelor's degree or diploma endorsement issued by the Council for Quality Assurance in General and Further Education and Training (Umalusi), with at least 50% (APS of 4) for English and 60% (APS of 5) for Mathematics and at least 60% (APS of 5) for Physical Sciences/Applied Engineering Technology/Materials and any two other vocational subjects.

Applicants with at least 50% (APS of 4) for English and 50% (APS of 4) for Mathematics (or 60% (APS of 5) for Mathematical Literacy) and 60% (APS of 5) for Mathematics and at least 60% (APS of 5) for Physical Sciences/Applied Engineering Technology/Materials and any two other vocational subjects will be considered for admission to the extended programme only.

Selection criteria:
To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **23**.

Applicants with a National N Certificate as published in Nated 191: N3 at (NQF level 4):
A National Senior Certificate or a N Certificate as published in Nated 191: N3 (NQF level 4) issued by the Council for Quality Assurance in General and Further Education and Training (Umalusi) with at least 50% (APS of 4) for English and 50% (APS of 4) for Mathematics.

b. *Assessment procedure:*
- No further selection will be done. Applicants will be considered for admission to either the National Diploma or the extended programme.
- Applicants who have been accepted, but whose final Grade 12 results are lower than what is prescribed in the admission requirements, will be moved to the extended programme (provided that they meet the minimum requirements of the programme).

c. *Minimum duration:*
Three years.

d. *Presentation:*
Day classes.

e. *Intake for the qualification:*
January and July.

f. *Exclusion and readmission:*
See Chapter 2 of Students' Rules and Regulations.

g. *Recognition of Prior Learning (RPL), equivalence and status:*
See Chapter 30 of Students' Rules and Regulations.

h. *Work-Integrated Learning I and II:*
See Chapter 5 of Students' Rules and Regulations.

i. *Engineering Council of South Africa (ECSA):*
The National Diploma: Engineering: Computer Systems is accredited by the Engineering Council of South Africa (ECSA), and students completing the qualification will be able to register with that Council. The Department or ECSA can be contacted for additional information and registration purposes.

j. *Assignments:*
Students must have access to personal computers to do assignments after hours.

k. *Subject credits:*
Subject credits are shown in brackets after each subject.

CURRICULUM

FIRST YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FIRST SEMESTER			
COS101T	Communication Skills I	(0,036)	
CSK101T	Computer Skills I	(0,055)	
DSY131C	Digital Systems I	(0,083)	
EEN111C	Electrical Engineering I	(0,083)	
ELC111B	Electronics I	(0,083)	
MAT141F	Mathematics I	(0,083)	
PGG111T	Programming I	(0,083)	
TOTAL CREDITS FOR THE SEMESTER:		0,506	
SECOND SEMESTER			
DSY231C	Digital Systems II	(0,083)	Digital Systems I
ELC211B	Electronics II	(0,083)	Electronics I

MAT251F	Mathematics II	(0,083)	Mathematics I
NSY211T	Network Systems II	(0,083)	
PGG211T	Programming II	(0,083)	Programming I
PJT101B	Projects I	(0,083)	Programming I

TOTAL CREDITS FOR THE SEMESTER: 0,498

TOTAL CREDITS FOR THE FIRST YEAR: **1,004**

SECOND YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FIRST SEMESTER			
DSY341C	Digital Systems III	(0,083)	Digital Systems II
NSY311T	Network Systems III	(0,083)	Network Systems II
OSY301T	Operating Systems III	(0,083)	Programming II
PGG311T	Programming III	(0,083)	Programming II
SYA201T	Systems Analysis II	(0,083)	
	plus one of the following subjects:		
DPC201T	Digital Process Control II	(0,083)	
MMA301T	Mathematical Applications III	(0,083)	Mathematics II
ORS311T	Operational Research III	(0,083)	Mathematics I

TOTAL CREDITS FOR THE SEMESTER: 0,498

SECOND SEMESTER			
DBR311T	Database Principles III	(0,083)	Programming II Systems Analysis II
LOD311B	Logic Design III	(0,083)	Digital Systems III
SFE311T	Software Engineering III	(0,083)	Programming III Systems Analysis II
	plus two of the following subjects that were not taken in the previous semesters:		
DPC201T	Digital Process Control II	(0,083)	
DPC301T	Digital Process Control III	(0,083)	Digital Process Control II
MMA301T	Mathematical Applications III	(0,083)	Mathematics II
ORS311T	Operational Research III	(0,083)	Mathematics I

TOTAL CREDITS FOR THE SEMESTER: 0,415

TOTAL CREDITS FOR THE SECOND YEAR: **0,913**

THIRD YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FIRST SEMESTER **On completion of all the above subjects.**			
EXP1ECS	Work-Integrated Learning I	(0,500)	

TOTAL CREDITS FOR THE SEMESTER: 0,500

SECOND SEMESTER

EXP2ECS	Work-Integrated Learning II	(0,500)	Work-Integrated Learning I
PJD301B	Design Project III	(0,083)	

TOTAL CREDITS FOR THE SEMESTER: 0,583

TOTAL CREDITS FOR THE THIRD YEAR: **1,083**

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

COMMUNICATION SKILLS I (COS101T) **CONTINUOUS ASSESSMENT**
(Subject custodian: Department of Applied Languages)
Communication theory, non-verbal communication (body language, etc.), oral presentations, interviews, developing leadership and participation skills. Technical reports and correspondence. (Total tuition time: ± 20 hours)

COMPUTER SKILLS I (CSK101T) **CONTINUOUS ASSESSMENT**
(Subject custodian: End User Computing Unit)
Students have to acquire practical skills as end-users in operating systems and MS Office Suite applications (MS Word, MS Excel and MS PowerPoint) on an introductory level, as well as in MS Access Essentials. Students will do online and computer-based tests. The modules are mapped with SAQA. (Total tuition time: ± 40 hours)

D

DATABASE PRINCIPLES III (DBR311T) **1 X 4-HOUR COMPUTER-BASED**
(Subject custodian: Department of Computer Science)
An introduction to databases and database management principles. Theoretical principles are applied in the query language SQL, using Oracle SQL. Students' insight and skills are tested in the development, design and implementation of a relational database. (Total tuition time: ± 60 hours)

DESIGN PROJECT III (PJD301B) **CONTINUOUS ASSESSMENT**
(Subject custodian: Department of Computer Systems Engineering)
The planning, design and implementation of an industry-related project by applying the knowledge obtained and the tools students were introduced to in the programme. The project should deal with an actual computer science problem and should include hardware and software elements. This subject is supported by short project management and entrepreneurship programmes. (Total tuition time: ± 10 hours)

DIGITAL PROCESS CONTROL II (DPC201T) **1 X 3-HOUR PAPER**
(Subject custodian: Department of Computer Systems Engineering)
Introduction to basic digital control techniques using an emulated PLC. Various realistic and practical projects are studied using the printer port as PLC. (Total tuition time: ± 80 hours)

DIGITAL PROCESS CONTROL III (DPC301T) **1 X 3-HOUR PAPER**
(Subject custodian: Department of Computer Systems Engineering)
A detailed examination of the functional operations of a PLC, as used in factory automation. An introduction to robotics, electromechanical and sensory tactics and methods. (Total tuition time: ± 80 hours)

DIGITAL SYSTEMS I (DSY131C) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Systems Engineering)

History and overview of digital systems, Number systems and codes, Binary arithmetic, Boolean algebra, Basic logic gates (AND, OR, NOT, NAND, NOR, XOR), Physical properties of logic gates (technology, fan-in, fan out, propagation delay), Networks of logic gates, 2-level networks (AND-OR, OR-AND, NAND-NAND, NOR-NOR), Elimination of timing hazards/glitches, Combinational systems, Arithmetic functions (adders, subtracters, carry look ahead), Introduction to memory elements. (Total tuition time: ± 70 hours)

DIGITAL SYSTEMS II (DSY231C) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Systems Engineering)

Un-clocked and clocked memory devices (latches, flip flops), Level vs edge sensitive and master- slave devices, Basic flip flops (SR, D, JK, T), Asynchronous flip flop inputs (preset, clear), Timing constraints (setup time, hold time) and propagation delays, Sequential logic circuits: data registers, shift registers, counters; Introduction to Finite state machines (FSM), CPLDs, FPGAs, ROMs, RAM, FLASH. (Total tuition time: ± 70 hours)

DIGITAL SYSTEMS III (DSY341C) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Systems Engineering)

Structure of a computer system (CPU, memory, I/O devices on a bus); CPU families used in microcontrollers (4-bit, 8-bit, 16-32-bit) and microprocessors; Basic I/O devices (timers/counters, GPIO, A/D, D/A), Polled I/O vs Interrupt driven I/O, Vectored and prioritised Interrupts, DMA transfers, MMU, Memory architectures and caches; Introduction of embedded application designs. (Total tuition time: ± 70 hours)

E

ELECTRICAL ENGINEERING I (EEN111C) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Systems Engineering)

Students are introduced to the correct use of SI units and their applications, the construction and maintenance of batteries, a network analysis of direct current circuits and AC theory, a study of various measuring instruments. An investigation into the effects of magnetic lines of force, the application and use of magnetic fields, inductance and the factors affecting it, capacitors and their operation. (Total tuition time: ± 70 hours)

ELECTRONICS I (ELC111B) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Systems Engineering)

Introduction to electronic components, analysis and design using measuring instruments, diodes and rectification, simple power supplies, DC operating point of single-stage bipolar junction- and field-effect transistor amplifiers and basic operational amplifier configurations. Theory supported by assessed practical experiments in a laboratory, including soldered and proto-board projects. (Total tuition time: ± 70 hours)

ELECTRONICS II (ELC211B) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Systems Engineering)

Modelling of electronic components and their application in circuit analysis and design. Unregulated and regulated linear power supplies with transistor and operational amplifier error correction, short-circuit protection and heat sink principles. Small-signal modelling of transistor amplifiers. Theory is supported by assessed project and practical experiments in a laboratory. (Total tuition time: ± 80 hours)

L

LOGIC DESIGN III (LOD311B) **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)

M

MATHEMATICAL APPLICATIONS III (MMA301T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Mathematics and Statistics)

First-order differential equations. Higher-order differential equations. Basic mathematical modeling. Laplace transforms. Systems of differential equations. Numerical solutions of differential equations. Fourier Series. (Total tuition time: ± 90 hours)

MATHEMATICS I (MAT141F) **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)

MATHEMATICS II (MAT251F) **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)

N

NETWORK SYSTEMS II (NSY211T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of information Technology)

This subject covers various aspects and technologies involved in data communications and networking. Students are introduced to topics, such as network topologies, transmission fundamentals, contention protocols, data compression techniques, data security and integrity, flow-control protocols and the various IEEE standards. The subject is aimed at giving students a solid understanding of local area networks (LANs), although aspects of wide area networks (WANs) are also covered briefly. (Total tuition time: ± 80 hours)

NETWORK SYSTEMS III (NSY311T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Information Technology)

This subject covers the TCP/IP protocol suite in detail, including protocols such as IPv4, IPv6, TCP, UDP, ICMP, DNS, FTP. Other networking concepts like packet addressing, forwarding, and routing are also covered. The student will be equipped with skills to plan IP addresses using VLSM and to configure networks. The practical component concentrates on basic design of data networks, IP address planning, creating VLANs, configuration of routers using dynamic protocols like RIP, OSPF, etc. (Total tuition time: ± 80 hours)

O

OPERATING SYSTEMS III (OSY301T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Systems Engineering)

The development of the operating system as a control programme and resource manager. Principles to take into consideration when designing a modern operating system, such as memory management, process management, scheduling and input/output. The LINUX operating system. CPU scheduling, parallelism, secondary memory management, LINUX applications. (Total tuition time: ± 80 hours)

OPERATIONAL RESEARCH III (ORS311T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Systems Engineering)

Aim/Purpose: To introduce students to the scientific approach to solving management science problems. Objectives: To be introduced to linear programming processes, Network modules, queuing and decision analysis, project scheduling, decision theory, forecasting, queuing models, simulation, inventory control. Key topics: Linear Programming, distribution and assignment problems, Network modules, project scheduling. (Total tuition time: ± 72 hours)

P

PROGRAMMING I (PGG111T) **1 X 4-HOUR COMPUTER-BASED**

(Subject custodian: Department of Computer Science)

This subject accommodates students from a broad spectrum of disciplines and interests. It includes a theoretical as well as a practical component. Aim: This subject provides overview coverage of introductory C++ programming. Objectives: This is a career-focused information and communication technology qualification that will enable a graduate to design and create ICT software solutions using basic object-orientated concepts and technologies. Key topics: Basic C++ programs, classes, problem solving, OOP, methods, data manipulation, arithmetic operators, decision structures, loop structures, functions. (Total tuition time: ± 72 hours)

PROGRAMMING II (PGG211T) **1 X 4-HOUR COMPUTER-BASED**

(Subject custodian: Department of Computer Science)

Aim/Purpose: To cover advanced OOP (Object Oriented Programming) principles, including inheritance and abstract programming, as well as other advanced concepts in C++. Objectives: To enable students to be able to create and manipulate one- and two-dimensional arrays, manipulate a collection of characters as strings; Read and write data from text files; Apply advanced class features. Key topics: One- and Two-Dimensional Arrays; Strings and Character Manipulation; Text Files, Additional Class Features; Inheritance; Polymorphism; Dynamic Memory Allocation. (Total tuition time: ± 72 hours)

PROGRAMMING III (PGG311T) **1 X 4-HOUR COMPUTER-BASED**

(Subject custodian: Department of Computer Science)

Aim: The student is introduced to a modern C++ Rapid Application Development Tool for Win32 with the purpose of creating a human interface for pre-engineered C and assembly applications. Objectives: The student must be able to manipulate standard Windows components, graphical images, multiple forms, grid structures, selection structures, menu systems and dynamically created objects. The integration of C as well as assembly language routines including pre-manufactured as well as self-manufactured objects. A medium sized C++ GUI project is expected to be completed towards the end of the semester. Key topics: Advanced OOP, C++, C, ASM, dynamic object instantiation, event-driven programming, Back-end classes, strategic solution planning, systematic program design, flat file data handling. (Total tuition time: ± 72 hours)

PROJECTS I (PJT101B) **CONTINUOUS ASSESSMENT**

(Subject custodian: Department of Computer Systems Engineering)

Use of instruments and equipment, such as multimeter, oscilloscope, power supply and function generator. Measurement of alternating and direct current, voltage and frequency. Component identification, application, measurement and testing. Reading basic schematic diagrams. Construction and testing of an electronic project. Stripping and insulating conductors. Wiring and placing components. Basic health and safety. Laboratory policies and procedures. Basic hand skills such as soldering, metal working including drilling. Building of a project into an enclosure. Web programming using appropriate Web system engineering environment such as http/html/php/MySqL/FORMS, which includes direct socket connections. (Total tuition time: ± 70 hours)

S

SOFTWARE ENGINEERING III (SFE311T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Science)

The purpose of this subject is to present the essential knowledge and skills needed to solve the customer and the user problems through the use of domain analysis which helps to have the background information as well as to gather and validate requirements. This subject enables students to learn how to apply software engineering skills into real life situation by understanding what constitutes a good requirement, applying fundamental design principles, gaining in-depth knowledge of object-oriented development using Unified Modeling Language, translating requirements and designs into good quality programs and to test the programs effectively. (Total tuition time: ± 60 hours)

SYSTEMS ANALYSIS II (SYA201T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Computer Science)

A detailed study of the five phases of the systems development life cycle (SDLC), giving the student an in-depth understanding of how information technology supports operational and business requirements in today's competitive environment. The importance of communication, economic analysis and project planning skills in all phases of the SDLC is discussed. (Total tuition time: ± 60 hours)

W

WORK-INTEGRATED LEARNING I (EXP1ECS) **WORK-INTEGRATED LEARNING**
WORK-INTEGRATED LEARNING II (EXP2ECS) **WORK-INTEGRATED LEARNING**
(Subject custodian: Department of Computer Systems Engineering)
Students experience the IT- or engineering-related industry by becoming involved in its day-to-day operations.
(Total tuition time: not available)