

# NATIONAL DIPLOMA: ENGINEERING: COMPUTER SYSTEMS (Extended curriculum programme with foundation provision) Qualification code: NDCYF0 - NQF Level 6

Campus where offered: Soshanguve South Campus

## Important notification to new applicants:

Students who intend to enrol 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 Potential students are advised to consult the University's website for any new qualifications which might not be published in this Prospectus.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 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).

**Recommended subject(s):**

Computer Studies.

**Assessment procedures:**

- 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 to National Diploma, 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.

• **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 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.

**Recommended subject(s):**

None.

**Selection criteria:**

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least 20.

**Assessment procedures:**

- 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 to National Diploma, 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.

• **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 an endorsement of a bachelor's degree or diploma 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 or 60% (APS of 5) for Mathematical Literacy and 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** (with Mathematics) or **24** with (Mathematical Literacy).

**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. *Minimum duration:*  
Three and a half years.
- c. *Presentation:*  
Day classes.
- d. *Intake for the qualification:*  
January only.
- e. *Exclusion and readmission, Work-Integrated Learning I and II, Recognition of Prior Learning (RPL), equivalence and status, Engineering Council of South Africa (ECSA) and assignments:*  
**See National Diploma: Engineering: Computer Systems (NDCY03).**
- f. *Subject credits:*  
Subject credits are shown in brackets after each subject.

Key to asterisks:

- \* Information does not correspond to information on approved AA72.  
(Deviations approved by the Senate in September 2015.)

<b>CURRICULUM</b>
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**FIRST YEAR**

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FPCOS03	Communication Skills (Extended) I	(0,036)	
FPCSK02	Computer Skills (Extended) I	(0,055)	
FPDSY01	Digital Systems (Extended) I	(0,083)	
FPEEN02	Electrical Engineering (Extended) I	(0,083)	
FPELC02	Electronics (Extended) I	(0,083)	
FPMAT04	Mathematics (Extended) I	(0,083)	
FPPGG01	Programming (Extended) I	(0,083)	
TOTAL CREDITS FOR THE FIRST YEAR:		<b>0,506</b>	

**SECOND YEAR**

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
<b>FIRST SEMESTER</b>			
DSY231C	Digital Systems II	(0,083)	Digital Systems (Extended) I
ELC211B	Electronics II	(0,083)	Electronics (Extended) I
MAT251F	Mathematics II	(0,083)	Mathematics (Extended) I
NSY211T	Network Systems II	(0,083)	
PGG211T	Programming II	(0,083)	Programming (Extended) I
PJT101B	Projects I	(0,083)	Programming (Extended) I
TOTAL CREDITS FOR THE SEMESTER:		0,498	

**SECOND SEMESTER**

DSY341C	Digital Systems III	(0,083)	Digital Systems II
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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)	
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 (Extended) I

TOTAL CREDITS FOR THE SEMESTER: 0,498

TOTAL CREDITS FOR THE SECOND YEAR: **0,996**

### THIRD YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
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#### FIRST 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 (Extended) I

TOTAL CREDITS FOR THE SEMESTER: 0,415

#### SECOND SEMESTER

**On completion of all the above subjects.**

EXP1ECS	Work-Integrated Learning I*	(0,500)	
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TOTAL CREDITS FOR THE SEMESTER: 0,500

TOTAL CREDITS FOR THE THIRD YEAR: **0,915**

### FOURTH YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
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#### FIRST 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 FOURTH YEAR: **0,583**

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 23 August 2017, the syllabus content was defined as follows:

### C

**COMMUNICATION SKILLS (EXTENDED) I (FPCOS03)** CONTINUOUS ASSESSMENT  
(*Subject custodian: Department of Applied Languages*)  
Speaking and communication skills, listening skills, reading for academic understanding, academic vocabulary, learning strategies and information gathering, writing, business and life skills. Oral presentations, technical reports, interviews, leadership and participation skills. Emphasis is placed on the use of different communication media in IT case studies. The basic concepts of hardware, software, data communication and elementary programming skills are covered in the theoretical component. The Windows operating system is studied. Application packages such as Microsoft Word and Excel are covered in the practical component. (Total Tuition time: ± 100 hours)

**COMPUTER SKILLS (EXTENDED) I (FPCSK02)** CONTINUOUS ASSESSMENT  
(*Subject custodian: End User Computing Unit*)  
Students have to acquire theoretical knowledge (computing fundamentals) and practical skills as end-users in operating systems and MS Office Suite applications (MS Word, MS Excel, MS Excel Intermediate, MS PowerPoint, MS Access Essentials and MS Visio Professional), graphic design and dealing with the Internet, networks and how to search for information. Students will do online and computer-based tests. The modules are mapped with SAQA and IC3 Essential Skills for Digital Literacy (international certification). (Total tuition time: ± 80 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 (EXTENDED) I (FPDSY01)** 1 X 3-HOUR PAPER  
(*Subject custodian: Department of Computer Systems Engineering*)  
Binary, octal, decimal and hexadecimal number systems. The 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, multivibrators, comparators, decoders, encoders, multiplexers and demultiplexers, binary adders, binary adder/subtractor and arithmetic logic units are also discussed. Clock timing and parallel versus serial transmission. Fan-in, fan-out, current ratings. Propagation delay. Digital logic gate ICs, TTL and CMOS logic families. Interfacing logic families. I/O voltages and noise margins. Powering logic families. Logic probes and logic pulsars. The theoretical information is supported by practical experiments in a laboratory. (Total Tuition time: ± 80 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 (EXTENDED) I (FPEEN02)****1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

The subject consists of theoretical and practical elements. Correct use of SI units and their applications. Physical and electrical quantities. Introduction to electricity. Introduction to electrical components such as the resistor, capacitor, inductor, transistors, colour code. Basic wiring skills, basic electromagnetics, transformer, basic DC and AC circuit theory. Network analysis on DC circuits and AC theory. An investigation of the magnetic lines of force and the application of magnetic fields. Inductance in DC circuits. RLC circuits and phase differences. Capacitors, their operation and applications. The practical sessions cover soldering, resistor circuits and advanced resistor networks, transistor and capacitor applications and the application of electromagnetism. (Total Tuition time: ± 80 hours)

**ELECTRONICS (EXTENDED) I (FPELC02)****1 X 3-HOUR PAPER****(Subject custodian: Department of Computer Systems Engineering)**

Basic concepts of electronics, such as current, voltage, resistance, electrical power, capacitance, and inductance. Mathematical model of currents and voltage through and across basic electrical elements such as resistors, capacitors and inductors. Ohm's law, the venin's theorem, and Kirchhoff's law. Ac and dc circuit theory. The basic concepts of electronics, such as the use of measuring instruments, the semi-conductor theory, the P-N junction, diodes and rectification, simple power supplies, the bipolar junction transistor, the field-effect transistor and operational amplifiers are studied. The theoretical presentations are supported by practical experiments in a laboratory. (Total Tuition time: ± 80 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 (EXTENDED) I (FPMAT04)****1 X 3-HOUR PAPER****(Subject custodian: Department of Mathematics and Statistics)**

Basic mathematics, including trigonometry, geometry, exponents and logarithms. Number theory and Boolean algebra. Set theory and logic. Introductory algebra. Basic statistics. Introduction to probability. Matrices. Vectors. Introductory calculus, differentiation and integration. Complex numbers. (Total Tuition time: ± 80 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 (EXTENDED) I (FPPGG01)****1 X 4-HOUR COMPUTER-BASED****(Subject custodian: Department of Computer Science)**

AIM/PURPOSE: To enable students to understand and be able to solve problems with the help of the Object orientated C++ programming language. OBJECTIVES: The student must be competent in problem-solving skills using C++ as a tool. KEY TOPICS: Classes and objects, selection and looping structures, library functions, one-dimensional arrays, basic technical programming. An introduction to Object-Orientated Programming (OOP), basic control structures and stream manipulation. (Total Tuition time: ± 80 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)

