Computer Science and Information Systems for the Colleges of Science, Engineering and Technology and Human Sciences
(offered by the School of Computing)
School telephone number 012 429 6122

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Introduction

In the College of Science, Engineering and Technology, Computer Science and Information Systems may both be taken as major subjects or can be combined with other subjects in the various streams of the Bachelor of Science in Information Technology and Computer Science specialisation degree. Eight streams are identified in this programme:

- Software Engineering
- Computational Intelligence
- Scientific Computing
- Information Technology Management
- Computational Statistics (Programming)
- Computational Statistics (Information Systems)
- Informatics and Decision Modelling
- Decision Modelling and Computing.

Full particulars of the various streams appear in Part 7 of the Calendar. Computer Science and Information Systems can also be taken as subjects in the College of Economic and Management Sciences (see the relevant sections in Parts 2 and 3 of the Calendar).

If you prefer not to choose any one of the streams within the BSc specialisations, you may compile your own curriculum. You may choose either Computer Science or Information Systems, or both, as major subjects. This amounts to making a particular choice of third-level modules in accordance with the alternatives described in 3. The student is then committed to including in the curriculum all the second-level Prerequisite of those modules, and the first-level Prerequisite of these. In the sections that follow, we will illustrate how the choice of third-level modules affects the choice of second- and first-level modules.

NB
All Computer Science and Information Systems modules are YEAR MODULES. See Section A for definitions and examinations.

1.1 COMPUTER SCIENCE AND HOW IT DIFFERS FROM INFORMATION SYSTEMS

There is some overlapping between Computer Science and Information Systems. You may therefore be interested in the reason for their existence as separate entities.

The use of computers for performing calculations, information processing, imitating human thought processes, in science and in organisations, covers a very wide field. Add to all that the study of the computer itself (as distinct from its application), and we have more material than can possibly be accommodated within one study area. Moreover, there is a whole area of knowledge relating to the development of computer-based information systems.

In Information Systems the main emphasis is on information processing. For example, attention is devoted to the following:

- how information must be processed in order to comply with requirements of timeousness, accuracy and usability.
- how data must be structured for the aforementioned processing.
- how the information system must be planned, designed and implemented in order to be able to supply information which will comply with the given requirements, emphasising the software engineering approach to information systems development.

In Computer Science, the emphasis is both on formal aspects of Computer Science and on practical areas such as programming and networks.

1.2 COMPUTER SCIENCE/INFORMATION SYSTEMS AND OTHER BSC SUBJECTS

Computers are used extensively in all scientific fields and therefore the study of Computer Science may usefully be combined with any BSc subject. The following combinations may serve as a guide if you are planning to set up your own curriculum:

(a) Scientific applications – if you are interested in a career in science, you may consider combining Computer Science with Physics, Mathematics, Operations Research or Statistics.

(b) If you plan to major in Information Systems, you could combine it with Statistics, Operations Research, and any BCom subject(s).

We recommend that, before you choose to compile your own curriculum, you should consider the streams within the specialisation degree in Information Technology and Computer Science described below: (for the curricula of these streams see Part 7 of the Calendar):

(a) Software Engineering Stream

This programme stream concerns the development of robust and reliable software. It will provide the BSc graduate with the knowledge, specific skills and applied and theoretical competence to occupy entry level positions involved in the development of computer based systems ranging from business
applications to software control systems in power plants, aircraft, medical devices, and so on. In this stream students major in both Computer Science and Information Systems.

(b) **Computational Intelligence Stream**

This programme stream concerns the development of computer software to solve problems in areas such as game playing, logical inference and theorem proving, planning, medical diagnosis, learning, vision, robotics, and natural language understanding. The programme aims to educate and train computational intelligence professionals/practitioners that possess and are able to apply these skills. This stream is a combination of modules from Computer Science, Psychology, Linguistics, and Philosophy.

(c) **Scientific Computing Stream**

This programme stream aims to educate and train practitioners/professionals with specialisation in computational abilities and scientific programming as applied in Mathematics, Statistics, Quantitative Management, Applied Mathematics, Geography, Physics, Chemistry. This stream is a combination of modules from Computer Science, Mathematics, Applied Mathematics, and Quantitative Management.

(d) **Information Technology Management Stream**

The emphasis of this stream is on information technology and the management thereof. The Information Technology Management stream has a strong technical bias, but includes business exposure to prepare students for a career in software development in a business environment and eventually for the management of information technology in an enterprise. This stream is a combination of modules from Information Systems, Computer Science, Business Management, Accounting, and Auditing.

(e) **Computational Statistics (Programming) Stream**

Statistics requires the intelligent, critical and judicious use of computers. This stream provides the necessary statistical and computational techniques and skills required to make a meaningful contribution to a computing team. This stream is a combination of modules from Computer Science and Statistics.

(f) **Computational Statistics (Information Systems) Stream**

This stream aims to educate and train statistical practitioners and professionals primarily involved in the business information needs of an organisation. It provides a sound understanding of computers, databases, and the essence of statistical theory. This stream is a combination of modules from Information Systems and Statistics.

(g) **Informatics and Decision Modelling Stream**

This programme provides the BSc graduate with the knowledge, specific skills and a broad theoretical and practical competence to use Operations Research and Information Systems in a decision-making environment. It aims to integrate modelling skills, algorithmic and heuristic techniques from Operations Research with computer systems principles and practice. It also prepares the graduate for postgraduate studies in Operations Research and/or Information Systems.

(h) **Decision Modelling and Computing Stream**

This programme provides the BSc graduate with the knowledge, specific skills and a broad theoretical and practical competence to use Operations Research and Computer Science in a decision-making environment. Graduates are equipped with the modelling skills and numerical and programming techniques needed to solve real-life decision and management problems. It also prepares the graduate for postgraduate studies in Operations Research and/or Computer Science.

1.3 **COMPUTER SCIENCE FOR THE COLLEGE OF HUMAN SCIENCES**

- Unless otherwise indicated in a specialist BA degree the TWO modules for BA students are COS113 and COS114.
- Students must choose between this subject and Information Systems for Humanities and Social Sciences. Credit for a BA degree can be granted for only one of these subjects.
- Mathematics at Matriculation level is not a prerequisite but is recommended.
- Students who select Economics or another subject from Group B as a major, may not include Computer Science in their curriculum.
- These modules are intended for students who are interested in learning to write computer programs. Information Systems (see below), on the other hand, is intended for students interested in learning how to use a computer as a tool. In this case students learn to use existing programs for word processing, spreadsheets and databases.

1.4 **INFORMATION SYSTEMS FOR THE COLLEGE OF HUMAN SCIENCES**

- Unless otherwise indicated in the specialist BA degree the TWO modules for BA students are INF105 and CEM101 (or INF120).
- For the BA degree students must choose between this course and the course in Computer Science for the College of Human Sciences. Credit will be granted for only one of these courses.
- Mathematics at Matriculation level is not a prerequisite.
- Students who select Economics or another subject from Group B as a major may not include Information Systems in their curriculum.
- Students who have completed this course do NOT qualify for admission to any second-year modules in Computer Science, but qualify for admission to second-year modules in Information Systems for degrees other than BA.

1.5 **REQUIREMENTS FOR ADMISSION TO POSTGRADUATE STUDIES**

Honours degrees are offered in both Computer Science and Information Systems. The respective admission rules are as follows:

In order to qualify for admission to study for an Honours BSc degree in Computer Science or Information Systems, students have to:

(i) hold a Bachelor's degree; and

(ii) have passed at least three relevant third-level modules in Computer Science (COS) and/or Information Systems (INF), or the equivalent thereof (eg Computer Science III or Information Systems III); and
have obtained an average of 60% in the three third-level modules.

Full particulars regarding Prerequisite, modules and syllabuses, and the compilation of a curriculum are contained in a separate brochure concerning postgraduate studies in Computer Science and Information Systems, which is available free of charge from the Registrar on application.

2 General Information

- The use of a pocket calculator is permissible in the examination for COS233 and 332.
- Practical work is required with the following modules: CEM101, COS111, 112, 114, 211, 214, 221, 233, 261, 311, 332, 340, 351 and INF307, 308 and 320. Students who register for these modules must have access to a suitable computer for the practical work.
- Note that the Mathematics modules MAT111, 112 and 103 are Prerequisite for the module COS233. Students who later intend to register for COS233 are advised to register for these modules together with the COS modules on first level.
- Credit for a degree is granted for:
  (i) either (COS111 and/or 112) or (COS151 and/or 152)
  (ii) either COS152 or INF103 or CEM101
  (iii) either COS13 or INF101 or COS121 or COS151
  (iv) either COS233 or APM213
  (v) either COS332 or APM311
  (vi) either COS161 or LGC101 (or PHE102)
  (vii) either COS261 or LGC205 (or PHE203)
  (viii) either COS361 or LGC305 (or PHE304)
  (ix) either INF105 or INF202
  (x) either INF205 or COS114
  (xi) either INF306 or COS226
  (xii) either INF203 or INF206
  (xiii) either INF206 or INF302

3 Computer Science and Information Systems as Major Subjects

Compulsory modules for a major subject combination:

If you choose to set up your own curriculum and not follow one of the eight suggested streams, then the following are the compulsory modules for a major subject. Please note that you must include all the Prerequisite and co-requisites for these modules in your curriculum as well. Both Computer Science and Information Systems may be taken as major subjects, provided that a module does not count as credit in both majors.

COMPUTER SCIENCE

First level: CEM101, COS101, 111, 112, 113
Second level: COS201, 211, (212 or 214), 221
Third level: a minimum of THREE third level COS modules chosen from the following list: COS301, COS311, COS321, COS340, COS351. The fourth module must be chosen either from this list or from the following list: COS332, COS361, INF303, INF305, (INF306 until 2002), INF307 (and INF303), INF308 (and INF305), INF320.

INFORMATION SYSTEMS

First level: CEM101, INF105, 120, COS114 (or INF205 (passed prior to 2002) or COS112)
Second level: INF206, INF207 (or INF203, INF204 passed prior to 2002)
Third level: INF303, 305 and any TWO of the following: INF320, (INF306 until 2002), INF307, INF308, COS311, COS340, COS351.

4 Syllabus

NB

All modules in this subject are offered as YEAR MODULES.

Computer Science

FIRST-LEVEL MODULES

COS101S Theoretical computer science 1*
Prerequisite: Mathematics as in Sc1(1)(b) or Sc10(1)(b) – see Part 7 of the Calendar
Purpose: to introduce students to some concepts from discrete Mathematics as a theoretical foundation for Computer Science. This background is relevant to relational databases, the development of provably correct programs, and the analysis of algorithms.

COS111U Introduction to programming 1 (3 hours)
Advice: Students who are not computer literate are advised to also enrol for CEM101 and COS113.
Purpose: to provide students with an introduction to programming and to cover the fundamentals of control structures, problem-solving techniques, and the incremental testing of programs.

COS112V Introduction to programming 2 (3 hours)*
Prerequisite: Mathematics as in Sc1(1)(b) or Sc10(1)(b) – see Part 7 of the Calendar as well as proof of sufficient programming experience. Such proof may be any ONE of the following:
validity via deduction and resolution in an interpreted

Purpose:

Prerequisite:

COS261C Formal logic 2*

least-squares approximation.

Purpose:

Prerequisite:

COS2269  Computer Networks I*

to design, and enable them to demonstrate basic skills in building simple applications graphically with visual tools, and directly using source code.

Purpose:

Prerequisite:

COS2338 Numerical methods 1 (3 hours)*

It includes solutions of non-linear equations and systems of linear equations, interpolating polynomials, numerical integration and differentiation, and least-squares approximation.

Purpose:

Prerequisite:

COS113W Computer systems: fundamental concepts*

Prerequisite: Mathematics as in Sc1(1)(b) or Sc10(1)(b) – see Part 7 of the Calendar

Purpose: to introduce students to the computer as a system. This covers hardware concepts such as internal representation of numbers and characters and basic computer architecture, and software concepts such as systems software and applications software. It also includes a brief introduction to databases, and to systems analysis and design.

Purpose:

Prerequisite:

COS161 or LGC101 or COS101

Purpose: to introduce students to the syntax of propositional language and the truth functionality of first-order language, enabling them to deal with proofs for validity via deduction and resolution in an interpreted first-order language.

Purpose:

Prerequisite:

COS2213 Computer organisation (3 hours)*

Co-requisite:

COS211

Purpose: to introduce students to the underlying structure of a modern digital computer, including digital logic level, machine code level and the software system level.

Purpose:

Prerequisite:

COS113 or INF105

Purpose: to equip students with the fundamental principles of data communication and computer networks, the knowledge and practical skills to design such networks, and the ability to take sound business decisions in a market which is becoming increasingly dominated by computer networks.

Purpose:

Prerequisite:

COS211 and (COS212 or 214)

Advice: Students are advised to complete COS111U prior to registering for COS112V if they have any doubts as to whether their programming experience is sufficient.

Purpose: to introduce students to the detailed design and implementation of algorithms as programs, and includes the fundamentals of simple data structures, including object-orientation.

Purpose:

Prerequisite:

COS101 or MAT212

Purpose: to enable students to understand and apply the basics of object-orientation, including inheritance, polymorphism, and encapsulation in a modern programming language. Students are also introduced to, and required to apply concepts relating to applets, network programming, events and event handling, multithreading, and exception handling.

Purpose:

Prerequisite:

COS112 and COS113

Co-requisite:

COS211

Purpose: to introduce students to the computer as a system. This covers hardware concepts such as systems software, and applications software. It also includes a brief introduction to databases, and to systems analysis and design.

Purpose:

Prerequisite:

COS301Y Theory of computer science 3*

Advice: Recommended for students who want to proceed to Honours Computer Science.

Purpose: to enable students to understand the concept of computability. In the process they are introduced to context-free languages, recursively enumerable languages and the machines that accept them. It includes details of the Chomsky hierarchy, pushdown automata and Turing machines.

Purpose:

Prerequisite:

COS211 and (COS212 or 214)

Advice: Students with no C++ or Java skills are strongly advised to also enrol for COS214.

Advice:

Co-requisites:

Prerequisite:

COS211

Purpose: to introduce students to the fundamentals of object-oriented and event-driven programming as well as the basics of graphical user interface (GUI) design, and enable them to demonstrate basic skills in building simple applications graphically with visual tools, and directly using source code.

Purpose:

Prerequisite:

COS201 and (COS212 or 214)

Advice: Students are advised to complete COS111U prior to registering for COS112V if they have any doubts as to whether their programming experience is sufficient.

Purpose: to introduce students to the detailed design and implementation of algorithms as programs, and includes the fundamentals of simple data structures, including object-orientation.
The registration fee for CEM101 includes an ICDL Logbook and all study material. Some so
dven tests a Unisa student will receive an ICDL issued by the ICDL Foundation, as well as credit for CEM101.

ICDL tests at any public ICDL Test Centre world-wide. Students are responsible for all test costs incurred, whether at Unisa or a public ICDL Test Centre. On completion of the

Unisa runs various ICDL authorised testing centres where Unisa students can take the internationally authorised ICDL tests (as discussed above). Students may also take the
an ICDL authorised testing centre.

The ICDL examination/testing procedure internationally requires a student to pass the tests for each of the seven units at any ICDL authorised testing centre anywhere

The uniqueness of this module lies in the examination/testing procedure. No formal Unisa examination paper is wri

A student who registers for CEM101 at Unisa in e

The ICDL is an international quali

In South-Africa it is administered by the Computer Society of South-Africa as the representative of the International Computer Driving Licence Foundation. It is also

The ICDL examination/testing procedure internationally requires a student to pass the tests for each of the seven units at any ICDL authorised testing centre anywhere in the world. The seven tests are all done on computer and recorded in a logbook. On completion of the seven tests, the student obtains an internationally recognised ICDL

A student who registers for CEM101 at Unisa in effect registers for an ICDL.

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Unisa runs various ICDL authorised testing centres where Unisa students can take the internationally authorised ICDL tests (as discussed above). Students may also take the ICDL tests at any public ICDL Test Centre world-wide. Students are responsible for all test costs incurred, whether at Unisa or a public ICDL Test Centre. On completion of the seven tests a Unisa student will receive an ICDL issued by the ICDL Foundation, as well as credit for CEM101.

The registration fee for CEM101 includes an ICDL Logbook and all study material. Some software packages are included, but some software packages need to be purchased by the student or the student needs to use the software packages provided in Unisa computer laboratories.

Advice:
1. Recommended for students with little previous knowledge of computers.
2. Exemption with credit for CEM101 will be granted to learners who hold their matriculation certificate and who possess one of the following qualifications:
   (a) ICDL (International Computer Drivers Licence)
   (b) MOS (Microsoft Office Specialist) Certification for Access, Excel, Outlook, Powerpoint and Word.
   (c) a qualification that, at the discretion of the Executive Dean, is equivalent to that in (a) or (b) above.
3. Exemption without credit for CEM101 will be granted to learners who have passed Computer Studies at matriculation level, and who can provide proof via the Dean’s office that the syllabi for CEM101 has been covered satisfactorily.

Purpose: to provide students with practical end-user computing skills of an Internationally Certified standard.
INF1059  Introduction to Business Information Systems*
Purpose: to introduce students to information technology concepts such as hardware, software, database management, telecommunications, and office automation. It also covers fundamentals of systems and information systems, types of information systems (eg transaction-processing systems, management information systems, decision support systems) and the management of business information systems.

INF1208  Human-computer interaction I*
Co-requisite: (INF103 or CEM101 or COS111 or 112 or 114) and (INF105 or COS113)
Purpose: to introduce the students to the subject of human-computer interaction and the importance of user-centred design. It covers the social, security, and safety aspects of computing and of using computers as a tool, various interaction devices and interface styles, and various aspects relating to the design and evaluation of interactive systems.

SECOND-LEVEL MODULES

INF206D  Systems analysis and design methods (3 hours)*
Prerequisite: INF105 or COS113 or INF101
Purpose: to introduce students to the role of the systems analyst in developing information systems. This requires knowledge of the systems development life cycle, systems development methods and techniques and process modelling during the analysis phase. Students are also introduced to the transition from analysis to design and input, output and user interface design.

INF207E  Object-oriented concepts (3 hours)*
Prerequisite: (INF105 or COS113 or INF101) and (INF103 or CEM101 or COS112 or COS114)
Purpose: to introduce the object-oriented (OO) approach and basic concepts, object modelling, application, object-oriented system development life cycles, and object-oriented analysis and design.

THIRD-LEVEL MODULES

INF303D  Principles of databases (3 hours)*
Prerequisite: COS211 or (INF203 and 204) or INF206 or INF207
Purpose: to introduce students to the fundamentals of databases and database management systems covering both single and distributed database systems, relational and object-oriented databases, and dealing with aspects such as normalisation, entity-relationship modelling, transaction management and concurrency control, data warehousing, and database administration.

INF305F  Advanced systems development (3 hours)*
Prerequisite: (INF203 or 206) and (INF204 or 207) and (COS112 or 114 or INF205)
Purpose: to introduce students to advanced topics in the analysis of information systems. This includes topics related to the software process, software engineering practice and the application of web engineering.

INF307H  Database design and implementation (3 hours)*
Co-requisite: INF303 and (COS112 or INF205 or COS114)
Purpose: to enable students to demonstrate their understanding of all the stages of developing a database application, using a Structured Query Language (SQL) and a commercial relational database management system.

INF308J  Software project management (3 hours)*
Prerequisite: (INF203 and 204) or INF206 or INF207
Co-requisite: COS112 or INF205 or COS114
Purpose: to enable students to demonstrate their understanding of managing all phases of a software development project, which includes project initiation and process analysis, resource planning and allocation, project design, risk management, monitoring and control of a project, managing people and teams, implementation and coordination of projects.

INF320E  Human-computer interaction II (3 hours)*
Prerequisite: INF120 and (COS214 or (COS114 and INF207))
Purpose: to provide students with a basic practical and theoretical introduction to human-computer interaction (HCI) and to HCI as a design discipline, extend their technical knowledge of dialogue styles, equip them with a basic set of analysis and evaluation techniques, familiarise them with current software tools for interactive system development, give students experience in the iterative nature of user interface development.

5  Practical Work and Admission Requirements

Practical work in Computer Science and Information Systems mainly comprises designing of systems and the writing of computer programs. The programs have to be developed on suitable computers using prescribed computer packages. Access to a suitable computer is an admission requirement for all modules with a practical component. Students can gain access as follows:
(i) by purchasing a computer for their own use; or
(ii) by using a computer belonging to a study group, friend, computer bureau, or employer; or
(iii) by reserving time on a computer at one of Unisa’s microcomputer laboratories in Pretoria, Johannesburg, Polokwane, Cape Town, Umtata and Durban.

The minimum configuration of a ‘suitable’ computer is described as follows:
- PC with a Pentium 233 MHz or higher processor
- Windows XP or later (required by most new software packages) although some of the older software will still run on Windows 98/2000 (i.e. for students already in the system).
- 128MB of RAM or higher
- 20 GB hard-disk space
- A CD-ROM drive
- VGA or higher graphics
A 3.5 inch high-density (1.44 MB) diskette drive
A printer that can print both text and graphics (minimum A4 paper size)

If you intend to buy a computer, we recommend that you obtain a computer with the highest processor speed and RAM you can afford, AND which is upgradable (to allow you to improve its configuration at a later stage).

The different software packages required by the modules are as follows:

**FIRST-LEVEL MODULES**
- COS111U: C++ compiler (supplied on CD)
- COS112V: C++ compiler (supplied on CD)
- COS114X: Delphi version 4 or higher for Windows 95 or higher.
- CEM101A: Microsoft Office XP or Microsoft Office 2007 (excluding Microsoft Access which is supplied by Unisa.).

**SECOND-LEVEL MODULES**
- COS211X: C++ compiler (supplied on CD)
- COS2338: Any suitable programming language
- COS2144: Java (supplied on CD)
- COS2213: NASM assembler (supplied on CD)
- COS261C: Students are required to use the program Tarski's World that is included with the prescribed textbook, and for this Microsoft Windows will be necessary.

**THIRD-LEVEL MODULES**
- COS3114: C++ compiler (supplied on CD)
- COS332A: Any suitable programming language
- COS351D: Any C++ compiler (for example the compiler supplied on CD)
- INF307H: Microsoft Access 2000 or higher
- INF320E: Java (supplied on CD) or Delphi 4 or higher

**NB**
Except where indicated as ‘(supplied on CD)’, Unisa CANNOT supply any of the commercial software packages mentioned. Students are required to either obtain their own copy of the software, or make use of the microcomputer laboratories. Full particulars of the microcomputer laboratories are supplied in the Unisa Brochure: Services and Procedures.