

# University of Pretoria Yearbook 2016

## BIT Information Technology (02130082)

**Duration of study** 4 years

**Total credits** 683

### Admission requirements

- In order to register NSC/IEB/Cambridge candidates must comply with the minimum requirements for degree studies as well as with the minimum requirements for the relevant study programme. • Life Orientation is excluded when calculating the APS.
- Grade 11 results are used in the provisional admission of prospective students. • A valid National Senior Certificate (NSC) with admission to degree studies is required. • Minimum subject and achievement requirements, as set out below, are required. On first-year level a student has a choice between Afrikaans and English as language medium. In certain cases, tuition may be presented in English only, for example in electives, where the lecturer may not speak Afrikaans or in cases where it is not economically or practically viable.
- Provisional admission to the four-year programme in the School of Engineering is only guaranteed if a prospective student complies with ALL the requirements below.

#### Note

Candidates who do not comply with the minimum requirements, set out above, but who have obtained a minimum APS of 30, an achievement level of 5 for English or Afrikaans, 6 for Mathematics and 5 for Physical Science, will be considered for provisional admission to either the four-year programme or the ENGAGE programme based on the results of the compulsory NBT.

Admission to ENGAGE in the School of Engineering will be determined by the results of the NBT, NSC results, an achievement level of 5 in Mathematics and 4 in Physical Science, as well as an achievement level of 4 in Afrikaans or English, together with an APS of 25.

Students may apply directly to be considered for the ENGAGE programme.

Minimum requirements for 2016								
Achievement level								
Afrikaans or English				Mathematics				APS
NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	
5	3	C	C	5	3	C	C	30 (26-29 admission based on the NBT)

- Should a candidate obtain an APS of 26 to 29 consideration for admission will be based on the results of the

NBT provided the quotas regarding student numbers have not been reached.

## Other programme-specific information

Note that a student who wishes to continue with an MSc(Computer Science) or MCom(Informatics) or MIS(Information Science) should take four of the five honours modules from that specific department in their fourth year of study.

## Promotion to next study year

Also consult the G Regulations.

- (i) A student is promoted to the following year of study after obtaining the required credits as mentioned below:
  - Second year of study after obtaining at least 70% of the credits of the first year of study.
  - Third year of study after obtaining at least 70% of the credits of the second year of study.
  - Fourth year of study after obtaining at least 70% of credits of the third year of study.
- (ii) The degree is conferred if all the prescribed modules have been passed.

# Curriculum: Year 1

Minimum credits: 176

## Fundamental modules

### Academic information management 101 (AIM 101)

**Module credits** 6.00

**Service modules**

Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences  
Faculty of Humanities  
Faculty of Law  
Faculty of Health Sciences  
Faculty of Natural and Agricultural Sciences  
Faculty of Theology  
Faculty of Veterinary Science

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Information Science

**Period of presentation** Semester 1

**Module content**

Find, evaluate, process, manage and present information resources for academic purposes using appropriate technology. Apply effective search strategies in different technological environments. Demonstrate the ethical and fair use of information resources. Integrate 21st-century communications into the management of academic information.

### Academic literacy for Information Technology 121 (ALL 121)

**Module credits** 6.00

**Service modules**

Faculty of Engineering, Built Environment and Information Technology  
Faculty of Economic and Management Sciences

**Prerequisites** No prerequisites.

**Contact time** 1 web-based period per week, 2 lectures per week

**Language of tuition** English

**Academic organisation** Unit for Academic Literacy

**Period of presentation** Semester 2

**Module content**

By the end of this module students should be able to cope more confidently and competently with the reading, writing and critical thinking demands that are characteristic of the field of Information Technology.

## Academic orientation 112 (UPO 112)

<b>Module credits</b>	0.00
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	EBIT Dean's Office
<b>Period of presentation</b>	Year

## Core modules

### Program design: Introduction 110 (COS 110)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
<b>Prerequisites</b>	COS 153 or COS 131 or COS 132 and Maths level 5 or WTW 133
<b>Contact time</b>	1 tutorial per week, 1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 2

#### Module content

The focus is on object-oriented (OO) programming. Concepts including inheritance and multiple inheritance, polymorphism, operator overloading, memory management (static and dynamic binding), interfaces, encapsulation, reuse, etc. will be covered in the module. The module teaches sound program design with the emphasis on modular code, leading to well structured, robust and documented programs. A modern OO programming language is used as the vehicle to develop these skills. The module will introduce the student to basic data structures, lists, stacks and queues.

### Software modelling 121 (COS 121)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	COS 153 or COS 131 or COS 132
<b>Contact time</b>	1 tutorial per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 2

#### Module content

The module will introduce the concepts of model-driven analysis and design as a mechanism to develop and evaluate complex software systems. Systems will be decomposed into known entities, such as design patterns, classes, relationships, execution loops and process flow, in order to model the semantic aspects of the system in terms of structure and behaviour. An appropriate tool will be used to support the software modelling. The role of the software model in the enterprise will be highlighted. Students who successfully complete this module will be able to conceptualise and analyse problems and abstract a solution.

## Introduction to computer science 151 (COS 151)

<b>Module credits</b>	8.00
<b>Service modules</b>	Faculty of Education
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1

### Module content

This module introduces concepts and terminology related to the computer science discipline. Topics covered include the history of computing, machine level representation of data, Boolean logic and gates, basic computer systems organisation, algorithms and complexity and automata theory. The module also introduces some of the subdisciplines of computer science, such as computer networks, database systems, compilers, information security and intelligent systems.

## Philosophy 120 (FIL 120)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Law
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 discussion class per week, 3 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Philosophy
<b>Period of presentation</b>	Semester 2

### Module content

Introduction to Philosophy

The two semester modules at first-year level introduce students to the four main subfields of Philosophy, namely epistemology and metaphysics, ethics and political philosophy. This module introduces students to two of these subfields. Students must contact the Department of Philosophy to ascertain which two subfields are covered in each semester as the choice may change from time to time due to availability of teaching staff. Students will become acquainted with the nature of philosophical reflection by exploring a number of classical philosophical themes in each subfield. Throughout the module there is an emphasis on developing those critical thinking, reading and writing skills that are required in Philosophy, while students become acquainted with the power of critique as critical judgment and discernment.

## Financial accounting 111 (FRK 111)

<b>Module credits</b>	10.00
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<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Law Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	4 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Accounting
<b>Period of presentation</b>	Semester 1

#### Module content

The nature and function of accounting; the development of accounting; financial position; financial result; the recording process; processing of accounting data; treatment of VAT; elementary income statement and balance sheet; flow of documents; accounting systems; introduction to internal control and internal control measures; bank reconciliations; control accounts; adjustments; financial statements of a sole proprietorship; the accounting framework.

### Information science 110 (INL 110)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Humanities
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 1

#### Module content

This module is an introduction to the study field of information science and its various professions. Key concepts that will be discussed include the following: the human as information processor and user; the life-cycle of information in terms of processes, products and role-players; as well as the communication of information. The social-ethical impact of globalisation is included as a key concern, with reference to Africa.

### Business management 114 (OBS 114)

<b>Module credits</b>	10.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	May not be included in the same curriculum as OBS 155
<b>Contact time</b>	3 lectures per week
<b>Language of tuition</b>	Both Afr and Eng

**Academic organisation** Business Management

**Period of presentation** Semester 1

### Module content

Introduction to business management as a science; the environment in which the enterprise operates; the field of business, the mission and goals of an enterprise; management and entrepreneurship. The choice of a form of enterprise; the choice of products and/or services; profit and cost planning for different sizes of operating units; the choice of location; the nature of production processes and the layout of the plant or operating unit. Introduction to and overview of general management, especially regarding the five management tasks: strategic management; contemporary developments and management issues; financial management; marketing and public relations. Introduction to and overview of the value chain model; management of the input; management of the purchasing function; management of the transformation process with specific reference to production and operations management; human resources management and information management; corporate governance and black economic empowerment (BEE).

## Calculus 114 (WTW 114)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences  
Faculty of Humanities

**Prerequisites** Refer to Regulation 1.2. Mathematics 60% Grade 12.

**Contact time** 1 tutorial per week, 4 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Mathematics and Applied Maths

**Period of presentation** Semester 1

### Module content

\*This module serves as preparation for students majoring in Mathematics (including all students who intend to enrol for WTW 218 and WTW 220). Students will not be credited for more than one of the following modules for their degree: WTW 114, WTW 158, WTW 134, WTW 165.

Functions, limits and continuity. Differential calculus of single variable functions, rate of change, graph sketching, applications. The mean value theorem, the rule of L'Hospital. Definite and indefinite integrals, evaluating definite integrals using anti-derivatives, the substitution rule.

## Discrete structures 115 (WTW 115)

**Module credits** 8.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences

**Prerequisites** Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 50% in the Grade 12 examination

**Contact time** 1 tutorial per week, 2 lectures per week

<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Mathematics and Applied Maths
<b>Period of presentation</b>	Semester 1

#### Module content

Propositional logic: truth tables, logical equivalence, implication, arguments. Mathematical induction and well-ordering principle. Introduction to set theory. Counting techniques: elementary probability, multiplication and addition rules, permutations and combinations, binomial theorem, inclusion-exclusion rule.

### Imperative programming 132 (COS 132)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	APS of 30 and level 5 (60-69%) Mathematics
<b>Contact time</b>	1 tutorial per week, 1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1

#### Module content

\*Note: All students registered for degrees within the School of IT, excluding the two four year programmes, BIS (Information Science) and BIS (Publishing), need to enrol for this module.

This module introduces imperative computer programming, which is a fundamental building block of computer science. The process of constructing a program for solving a given problem, of editing it, compiling (both manually and automatically), running and debugging it, is covered from the beginning. The aim is to master the elements of a programming language and be able to put them together in order to construct programs using types, control structures, arrays, functions and libraries. An introduction to object orientation will be given. After completing this module, the student should understand the fundamental elements of a program, the importance of good program design and user-friendly interfaces. Students should be able to conduct basic program analysis and write complete elementary programs.

### Financial accounting 122 (FRK 122)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Law Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	FRK 111 GS or FRK 133, FRK 143
<b>Contact time</b>	4 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Accounting
<b>Period of presentation</b>	Semester 2



## Module content

Budgeting, payroll accounting, taxation – income tax and an introduction to other types of taxes, credit and the new Credit Act, insurance, accounting for inventories (focus on inventory and the accounting entries, not calculations), interpretation of financial statements.

## Informatics 171 (INF 171)

**Module credits** 20.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Natural and Agricultural Sciences

**Prerequisites** Regulation 1.2: A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination

**Contact time** 2 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Informatics

**Period of presentation** Year

## Module content

General systems theory, creative problem solving, soft systems methodology. The systems analyst, systems development building blocks, systems development, systems analysis methods, process modelling.

## Linear algebra 146 (WTW 146)

**Module credits** 8.00

**Service modules** Faculty of Education

**Prerequisites** Refer to Regulation 1.2

**Contact time** 2 lectures per week, 1 tutorial per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Mathematics and Applied Maths

**Period of presentation** Semester 2

## Module content

\*Students will not be credited for more than one of the following modules for their degree:

WTW 124, WTW 146 and WTW 164. The module WTW 146 is designed for students who require Mathematics at 100 level only and does not lead to admission to Mathematics at 200 level.

Vector algebra, lines and planes, matrix algebra, solution of systems of equations, determinants. Complex numbers and polynomial equations. All topics are studied in the context of applications.

## Curriculum: Year 2

Minimum credits: 170

### Core modules

#### Data structures and algorithms 212 (COS 212)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	COS 110
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1

#### Module content

Data abstraction is a fundamental concept in the design and implementation of correct and efficient software. In prior modules, students are introduced to the basic data structures of lists, stacks and queues. This module continues with advanced data structures such as trees, hash tables, heaps and graphs, and goes into depth with the algorithms needed to manipulate them efficiently. Classical algorithms for sorting, searching, traversing, packing and game playing are included, with an emphasis on comparative implementations and efficiency. At the end of this module, students will be able to identify and recognise all the classical data structures; implement them in different ways; know how to measure the efficiency of implementations and algorithms; and have further developed their programming skills, especially with recursion and polymorphism.

#### Netcentric computer systems 216 (COS 216)

Module credits	16.00
Prerequisites	COS 110
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1

## Module content

This module introduces the principles of netcentric computing that can be applied to the WWW and internet as well as to distributed applications. After completing this module, a student will have gained, as outcomes, knowledge of how to integrate various programming and web-based technologies. Particular outcomes include gaining knowledge on the concepts of client and server side programming, web-based applications, port and socket interaction, writing programmes that require remote function calls and achieving database connectivity using remote SQL calls. The supporting technologies of mark-up languages like HTML and scripting languages like JavaScript are also studied. In order to practically demonstrate that a student has reached these outcomes, students will be required to use, integrate and maintain the necessary software and hardware by completing a number of smaller practical assignments whereafter integrating all these technologies into a comprehensive and practical netcentric programming project is required.

## Operating systems 222 (COS 222)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** COS 153 or COS 131 or COS 132

**Contact time** 1 practical per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Computer Science

**Period of presentation** Semester 2

## Module content

Fundamental concepts of modern operating systems in terms of their structure and the mechanisms they use are studied in this module. After completing this module, students will have gained, as outcomes, knowledge of real time, multimedia and multiple processor systems, as these will be defined and analysed. In addition, students will have gained knowledge on modern design issues of process management, deadlock and concurrency control, memory management, input/output management, file systems and operating system security. In order to experience a hands-on approach to the knowledge students would have gained from studying the abovementioned concepts, students will have produced a number of practical implementations of these concepts using the Windows and Linux operating systems.

## Computer organisation and architecture 284 (COS 284)

**Module credits** 16.00

**Prerequisites** COS 110

**Contact time** 1 practical per week, 4 lectures per week

**Language of tuition** English

**Academic organisation** Computer Science

**Period of presentation** Semester 2

## Module content

This module provides the foundations on which other modules build by enabling a deeper understanding of how software interacts with hardware. It will teach the design and operation of modern digital computers by studying each of the components that make up a digital computer and the interaction between these components. Specific areas of interest, but not limited to, are: representation of data on the machine-level; organisation of the machine on the assembly level; the architecture and organisation of memory; inter- and intra-component interfacing and communication; data paths and control; and parallelism. Topic-level detail and learning outcomes for each of these areas are given by the first 6 units of 'Architecture and Organisation' knowledge area as specified by the ACM/IEEE Computer Science Curriculum 2013.

The concepts presented in the theory lectures will be reinforced during the practical sessions by requiring design and implementation of the concepts in simulators and assembly language using an open source operating system.

## Multimedia 210 (IMY 210)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	IMY 110 or equivalent HTML knowledge
<b>Contact time</b>	2 lectures per week, 2 practicals per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 1

## Module content

\*Closed - requires departmental selection.

Advanced Markup Languages. This module investigates XML and its related technologies (such as XSLT, XPath, XSL-FO, DTD, XML Schema, and namespaces) as a vital part of the web development process.

## Multimedia 220 (IMY 220)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	IMY 210
<b>Contact time</b>	2 practicals per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 2

## Module content

\*Closed - requires departmental selection.

Advanced Markup Languages 2 - This module assumes knowledge of dynamic scripts and basic web based technologies such as PHP as well as the use of relational databases like MySQL. The module explores the interplay between scripting languages, databases, and current industry standard web technologies, from both the server-side and client-side perspectives. The module has a focus on developing hands-on practical skills.

## Informatics 214 (INF 214)

**Module credits** 14.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Natural and Agricultural Sciences

**Prerequisites** AIM 101 or AIM 111 and AIM 121

**Contact time** 2 practicals per week, 2 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Informatics

**Period of presentation** Semester 1

### Module content

Database design: the relational model, structured query language (SQL), entity relationship modelling, normalisation, database development life cycle; practical introduction to database design. Databases: advanced entity relationship modelling and normalisation, object-oriented databases, database development life cycle, advanced practical database design.

## Informatics 271 (INF 271)

**Module credits** 14.00

**Service modules** Faculty of Education

**Prerequisites** AIM 101 or AIM 102 or AIM 111 and AIM 121, INF 163, 164

**Contact time** 1 practical per week, 1 lecture per week, 2 discussion classes per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Informatics

**Period of presentation** Year

### Module content

Systems analysis. Systems design: construction; application architecture; input design; output design; interface design; internal controls; program design; object design; project management; system implementation; use of computer-aided development tools.

## Informatics 272 (INF 272)

**Module credits** 14.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education

**Prerequisites** AIM 101 or AIM 102 or AIM 111 and AIM 121, INF 163 and INF 164, Regulation IT.3(g)

**Contact time** 2 practicals per week, 1 discussion class per week, 5 web-based periods per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Informatics

**Period of presentation** Year

**Module content**

Use of computer-aided development tools; advanced programming.

### Information science 210 (INL 210)

**Module credits** 20.00

**Service modules** Faculty of Humanities

**Prerequisites** AIM 101 or AIM 102 or AIM 111 and 121

**Contact time** 3 practicals per week, 3 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Information Science

**Period of presentation** Semester 1

**Module content**

Information seeking and retrieval. This module explores the theory and practice of effective information seeking and retrieval. It builds on supporting research paradigms such as the systems, user-centred, cognitive and socio-cognitive paradigms. The focus is on the complexities of effective information seeking and retrieval within the context of information behaviour on a personal level, as well as in the context of professional, academic or everyday information needs.

### Information science 240 (INL 240)

**Module credits** 20.00

**Service modules** Faculty of Humanities

**Prerequisites** No prerequisites.

**Contact time** 3 practicals per week, 3 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Information Science

**Period of presentation** Semester 1

**Module content**

Social and ethical impact. This module examines moral and legal regulation practices related to information in print and digital environments. Different ethical theories are identified and applied to privacy, access to information, information poverty and censorship. The interpretation and enforcement of rules and regulations are discussed.

### Discrete structures 285 (WTW 285)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education

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<b>Prerequisites</b>	WTW 115
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Mathematics and Applied Maths
<b>Period of presentation</b>	Semester 2

**Module content**

Setting up and solving recurrence relations. Equivalence and partial order relations. Graphs: paths, cycles, trees, isomorphism. Graph algorithms: Kruskal, Prim, Fleury. Finite state automata.

## Curriculum: Year 3

Minimum credits: 186

### Core modules

#### Software engineering 301 (COS 301)

Module credits	27.00
Prerequisites	COS 110 and COS 121
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Year

##### Module content

The module exposes students to problems associated with software development on an industrial scale. Overall goals of the module are: to become familiar with the latest trends in software engineering; to understand the software engineering process and to appreciate its complexity; to be exposed to a variety of methodologies for tackling different stages of the software lifecycle; to understand and apply the concepts of systems administration and maintenance; to complete the development of a fairly large object orientation-based software product. The focus of the module is on a project that lasts the whole year. The project is completed in groups of approximately four (4) students and teaches students to take responsibility for a variety of roles within a group, and to understand the different requirements for these; to experience the advantages and problems of working in a group; professionalism with regards to particularly colleagues and clients.

After the successful completion of this module, the student will be able to: understand the psychology of a client; work in groups; and have an appreciation for planning, designing, implementing and maintaining large projects. These qualities should place the students in a position in which they are able to handle software development in the corporate environment.

#### Artificial intelligence 314 (COS 314)

Module credits	18.00
Prerequisites	COS 131 or COS 110
Contact time	1 practical per week, 2 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1



## Module content

The main objective of this module is to introduce a selection of topics from artificial intelligence (AI), and to provide the student with the background to implement AI techniques for solving complex problems. This module will cover topics from classical AI, as well as more recent AI paradigms. These topics include: search methods, game playing, knowledge representation and reasoning, machine learning, neural networks, genetic algorithms, artificial life, planning methods, and intelligent agents. In the practical part of this module, students will get experience in implementing

- (1) game trees and evolving game-playing agents;
- (2) a neural network and applying it to solve a real-world problem; and
- (3) a genetic algorithm and applying it to solve a real-world problem.

## Database systems 326 (COS 326)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	INF 214 or TDH
<b>Contact time</b>	1 lecture per week, 2 practicals per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 2

## Module content

This module builds on a prior introductory module on database technology and provides more advanced theoretical and practical study material.

## Computer networks 332 (COS 332)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	COS 216
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1

## Module content

The objective of this module is to acquaint the student with the terminology of communication systems and to establish a thorough understanding of exactly how data is transferred in such communication networks, as well as applications that can be found in such environments. The study material includes: concepts and terminology, the hierarchy of protocols according to the OSI and TCP/IP models, protocols on the data level, physical level and network level as well as higher level protocols. The practical component of the module involves programming TCP/IP sockets using a high level language. The emphasis throughout is on the technical aspects underlying the operation of networks, rather than the application of networks.

## Programming languages 333 (COS 333)

<b>Module credits</b>	18.00
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<b>Prerequisites</b>	COS 110
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 2

#### Module content

Programming languages are the backbone for software development. Each language has its own different syntax and semantics, but there are many common concepts that can be studied and then illustrated through the languages. The module concentrates on issues of object orientation, including delegation, iteration and polymorphism. It surveys how languages provide the basic building blocks for data and control, as well as exception handling and concurrency. At the end of the module, students will be able to appreciate the rich history behind programming languages, leading to independent principles that evolve over time. They will be skilled at using a variety of programming languages, including new paradigms such as functional, logical and scripting, and will know how to learn a new language with ease. From this experience, they will be able to apply evaluation criteria for choosing an appropriate programming language in a given scenario.

### Compiler construction 341 (COS 341)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	COS 212
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1

#### Module content

This module will introduce the student to the fundamentals of compiler construction. These include: the structural difference between a high-level and a von-Neumann language, the meaning of syntax and semantics and what semantics-preserving correctness means; the concepts of regular expressions, finite automata, context-free grammars in the context of programming languages; the need to construct parse-trees for given programmes; the application of data structures and algorithms for the purpose of code-analysis, code-optimisation and register-allocation; and the limits of code-analysis in terms of undecideability and the halting problem.

After successful completion of the module, the student will have an understanding of the importance of compilers and will understand how to implement a compiler, in terms of its components, the scanner, parser, type checker and code-generator for a given grammar.

### Computer graphics 344 (COS 344)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	COS 110 and WTW 126
<b>Contact time</b>	1 practical per week, 2 lectures per week



<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1

#### Module content

The aim of this module is to acquire a sound knowledge of the basic theory of interactive computer graphics and basic computer graphics programming techniques. The theory will cover graphics systems and models, graphics programming, input and interaction, geometric objects and transformations, viewing in 3D, shading, rendering techniques, and introduce advanced concepts, such as object-oriented computer graphics and discrete techniques. The module includes a practical component that enables students to apply and test their knowledge in computer graphics. The OpenGL graphics library and the C programming language will be used for this purpose.

### Multimedia: Project 300 (IMY 300)

<b>Module credits</b>	45.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Year

#### Module content

\*Closed – requires departmental selection. The module enables students to combine all their knowledge gained through out their studies to create a functional game. The course consists of extensive game design theory teaching. The students create a game by following an iterative design process, extensive documentation and in depth play testing and usability testing. The final product is a creative, innovative and complete game.

### Informatics 315 (INF 315)

<b>Module credits</b>	15.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
<b>Prerequisites</b>	INF 261, INF 225, INF 271 and INF 272
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Informatics
<b>Period of presentation</b>	Semester 1

#### Module content

A review of current trends which are relevant to the application of information systems within a business environment.

## Informatics 324 (INF 324)

**Module credits** 15.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education

**Prerequisites** INF 261, INF 225, INF 271 and INF 272

**Contact time** 3 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Informatics

**Period of presentation** Semester 2

### Module content

Information systems in organisations, social and ethical responsibilities, the role of the Informatician. IT end-user relationships; IT management.

## Informatics 354 (INF 354)

**Module credits** 15.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education

**Prerequisites** INF 261, INF 225, INF 271 and INF 272

**Contact time** 2 lectures per week, 2 practicals per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Informatics

**Period of presentation** Semester 1

### Module content

Advanced programming.

## Informatics 370 (INF 370)

**Module credits** 30.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Economic and Management Sciences

**Prerequisites** INF 261, INF 225, INF 271 and INF 272

**Contact time** 2 lectures per week, 2 practicals per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Informatics

**Period of presentation** Year



### Module content

Application of systems analysis and design in a practical project; programming; use of computer-aided development tools.

## Information science: Information organisation 310 (INL 310)

**Module credits** 30.00

**Service modules** Faculty of Humanities

**Prerequisites** No prerequisites.

**Contact time** 3 practicals per week, 3 lectures per week

**Language of tuition** English

**Academic organisation** Information Science

**Period of presentation** Semester 1

### Module content

Information Organisation. The module is concerned with the organisation of information in the digital environment focusing on the structure and use of document management and workflow systems, as well as distribution channels and virtual environments. The characteristics and application of the internet, intranets, as well as portals and applications use, are considered.

## Information science: Information and knowledge management 320 (INL 320)

**Module credits** 30.00

**Service modules** Faculty of Humanities

**Prerequisites** No prerequisites.

**Contact time** 3 practicals per week, 3 lectures per week

**Language of tuition** English

**Academic organisation** Information Science

**Period of presentation** Semester 2

### Module content

Information and Knowledge Management. This module focuses on information and knowledge management at an operational level and introduces information and knowledge management at a corporate strategic level. It deals with the management of information and knowledge, which enables the organisation to be competitive. In this module the focus is on four aspects, namely: the 21st century organisation, the external and internal stakeholders that have an interest in information products, as well as the infrastructure that should be in place in organisations to manage information products. The module concludes with a few topics relating to information management at a corporate strategic level.

## Computer security and ethics 330 (COS 330)

**Module credits** 18.00

**Prerequisites** COS 110

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**Contact time** 2 lectures per week, 1 practical per week

**Language of tuition** English

**Academic organisation** Computer Science

**Period of presentation** Semester 2

**Module content**

This module develops an appreciation of the fundamentals and design principles for information assurance and security. Students will develop a clear understanding of the basic information security services and mechanisms, enabling them to design and evaluate the integration of solutions into the user application environment. Emphasis will be placed on services such as authorisation and confidentiality. Students will acquire knowledge and skills of Security Models such as the Bell-LaPadula, Harrison-Ruzzo Ullman and Chinese Wall Model. Students will develop a detailed understanding of the confidentiality service by focusing on cryptology and the practical implementation thereof. The student will be introduced to professional and philosophical ethics. At the end of the module students will be able to engage in a debate regarding the impact (local and global) of computers on individuals, organisations and society. The professionalism of IT staff will be discussed against national and international codes of practices such as those of the CSSA, ACM and IEEE.

## Curriculum: Final year

Minimum credits: 151

### Core modules

#### Business law 310 (BER 310)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** No prerequisites.

**Contact time** 4 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Mercantile Law

**Period of presentation** Semester 1

#### Module content

Introduction to law. General principles of the law of contract. Specific contracts: purchase contracts; letting and hiring of work; employment contracts. Agency. General aspects of entrepreneurial law. Dispute resolution – mediation and arbitration.

#### Community-based project 202 (JCP 202)

**Module credits** 8.00

**Service modules** Faculty of Economic and Management Sciences

**Prerequisites** No prerequisites.

**Contact time** 1 other contact session per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Informatics

**Period of presentation** Year

## Module content

This project-orientated module is a form of applied learning which is directed at specific community needs and is integrated into all undergraduate academic programmes offered by the Faculty of Engineering, Built Environment and Information Technology.

The main objectives with the module are as follows:

- (1) The execution of a community-related project aimed at achieving a beneficial impact on a chosen section of society, preferably but not exclusively, by engagement with a section of society which is different from the student's own background.
- (2) The development of an awareness of personal, social and cultural values, an attitude to be of service, and an understanding of social issues, for the purpose of being a responsible professional.
- (3) The development of important multidisciplinary and life skills, such as communication, interpersonal and leadership skills.

Assessment in this module will include all or most of the following components: evaluation and approval of the project proposal, assessment of oral and/or written progress reports, peer assessment in the event of team projects, written report-back by those at which the project was aimed at, and final assessment on grounds of the submission of a portfolio and a written report.

## Industry-based learning 700 (SIT 700)

<b>Module credits</b>	52.00
<b>Prerequisites</b>	No prerequisites.
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	School of Information Technolo
<b>Period of presentation</b>	Semester 2

## Elective modules

### Multimedia trends 771 (IMY 771)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 2

## Module content

History of multimedia ideas and technology; current trends in multimedia, latest technologies and future trends of multimedia.

### Hypermedia and mark-up languages 772 (IMY 772)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.





**Contact time** 1 lecture per week

**Language of tuition** English

**Academic organisation** Information Science

**Period of presentation** Semester 1

#### Module content

A study of hypermedia systems, specifically adaptive hypermedia systems, as well as data modelling, storage and retrieval, database structures and metadata. A study of different mark-up languages and their role in multimedia products with the emphasis on data structuring, hyper linking theories and models.

### Multimedia technology 773 (IMY 773)

**Module credits** 15.00

**Prerequisites** No prerequisites.

**Contact time** 1 lecture per week

**Language of tuition** English

**Academic organisation** Information Science

**Period of presentation** Semester 1

#### Module content

In this module students will research and discuss a current topic which can change from year to year. The topic for a specific year can be obtained from the departmental website. The topic is related to the creative use of Multimedia Technologies. An understanding of the current multimedia trends is required together with the knowledge of its usage.

### Animation theory and practice 777 (IMY 777)

**Module credits** 15.00

**Service modules** Faculty of Economic and Management Sciences

**Prerequisites** No prerequisites.

**Contact time** 1 lecture per week

**Language of tuition** English

**Academic organisation** Information Science

**Period of presentation** Semester 1

#### Module content

This module provides an overview of the historic and current principles and practice of natural motion animation. Different animation techniques are covered, such as stop motion, traditional animation, and 3D animation. The student receives an opportunity to create an animated short film using a technique of their choice.

### Human-computer interaction 779 (IMY 779)

**Module credits** 15.00

**Prerequisites** No prerequisites.



**Contact time** 1 lecture per week

**Language of tuition** English

**Academic organisation** Information Science

**Period of presentation** Semester 2

#### **Module content**

In this module, students are exposed to research topics and methodologies within the HCI discipline. Students then apply their understanding by proposing and delivering a research paper.

### **Capita selecta 713 (INF 713)**

**Module credits** 15.00

**Prerequisites** No prerequisites.

**Contact time** 1 web-based period per week, 8 lectures per week

**Language of tuition** English

**Academic organisation** Informatics

**Period of presentation** Semester 1 or Semester 2

#### **Module content**

This module will be used to present special, relevant topics within the expertise of the department.

### **Research methodology 714 (INF 714)**

**Module credits** 15.00

**Prerequisites** No prerequisites.

**Contact time** 1 lecture per week, 1 web-based period per week

**Language of tuition** English

**Academic organisation** Informatics

**Period of presentation** Semester 1

#### **Module content**

This compulsory module explains different approaches that can be used for research in Informatics and gives practical advice with respect to carrying out limited research projects. It also assists students in selecting suitable research topics and writing research proposals in preparation for the research paper, which they will write in INF 780.

### **Enterprise architecture 715 (INF 715)**

**Module credits** 15.00

**Prerequisites** INF 788

**Contact time** 1 lecture per week

**Language of tuition** English

**Academic organisation** Informatics

**Period of presentation** Semester 1

### Module content

Enterprise Architecture (EA) involves comprehensive business frameworks that capture the complexity of modern organisations, providing a blue-print for co-ordinating and integrating all components of an organisation. The module will illustrate all the aspects of EA, discuss the need for EA as well as various frameworks, methods and techniques of EA.

## Research report 780 (INF 780)

**Module credits** 30.00

**Prerequisites** INF 714

**Contact time** 1 other contact session per week, 1 web-based period per week

**Language of tuition** English

**Academic organisation** Informatics

**Period of presentation** Semester 1

### Module content

A research paper on a topic from the field of informatics.

## Advanced database systems 785 (INF 785)

**Module credits** 15.00

**Prerequisites** No prerequisites.

**Contact time** 1 lecture per week, 1 web-based period per week, 1 other contact session per week

**Language of tuition** English

**Academic organisation** Informatics

**Period of presentation** Semester 1 or Semester 2

### Module content

- Advanced database design
- Advanced database management
- Database architectures and languages
- Data warehousing and data marts
- Current trends

## Managing projects and end-users 787 (INF 787)

**Module credits** 15.00

**Prerequisites** No prerequisites.

**Contact time** 1 lecture per week, 1 web-based period per week

**Language of tuition** English

**Academic organisation** Informatics



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<b>Period of presentation</b>	Semester 1
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**Module content**

Main emphasis will be on IS project management using a case study to get practical experience in project management.

**Information systems development 788 (INF 788)**

<b>Module credits</b>	15.00
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<b>Prerequisites</b>	No prerequisites.
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<b>Contact time</b>	1 lecture per week, 1 web-based period per week
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<b>Language of tuition</b>	English
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<b>Academic organisation</b>	Informatics
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<b>Period of presentation</b>	Semester 1
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**Module content**

Study and evaluation of different systems development methodologies.

**Capita selecta 790 (INF 790)**

<b>Module credits</b>	15.00
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<b>Prerequisites</b>	No prerequisites.
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<b>Contact time</b>	1 web-based period per week, 1 lecture per week
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<b>Language of tuition</b>	English
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<b>Academic organisation</b>	Informatics
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<b>Period of presentation</b>	Semester 1 or Semester 2
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**Module content**

This module will be used to present special, relevant topics within the expertise of the department.

**Knowledge acquisition and sharing 791 (INF 791)**

<b>Module credits</b>	15.00
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<b>Prerequisites</b>	No prerequisites.
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<b>Contact time</b>	1 lecture per week, 2 web-based periods per week, 1 practical per week
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<b>Language of tuition</b>	English
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<b>Academic organisation</b>	Informatics
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<b>Period of presentation</b>	Semester 1
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## Module content

In this information age a lot of data is captured every day and recorded in databases, but the wealth of this data is kept locked in the databases because relatively little mining is performed on this data. This module introduces you to data mining in terms of:

- The data mining process - how do you mine data?
- The data mining techniques - an overview of the data mining techniques that can be used;
- Practical data mining experience - a practical project mining real industry data to find unknown patterns; and
- Product overviews - product demonstrations by data mining vendors.

## Research methodology 711 (INY 711)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 1

## Module content

Research methodology and the application thereof to resolve research problems and to create new knowledge, is a valued advantage to any student. The module is compiled with the following objectives in mind: to instruct the student in the basic principles of research and to avail them the opportunity to execute research projects in a professional manner. Students are guided from the selection of a problem to the presentation of a complete research report with practical suggestions based on a solid theoretical framework.

## Information ethics 715 (INY 715)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	See departmental website

## Module content

This module focuses on the main moral issues pertaining to information and ICT, globalisation, privacy and knowledge flow. It covers amongst others the following fields: cyber warfare and terrorism; information philosophy; information security; privacy and the right to information; digital identity management; cyber law; globalisation and the impact on society.

## Information and knowledge management (II) 716 (INY 716)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	INY 713

<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	See departmental website

#### Module content

This module offers the student the opportunity to become conversant with various knowledge management programmes as well as the development, implementation and evaluation of knowledge management strategies. Knowledge representation and the development of an Intranet will be covered. New key issues in the field of knowledge management conclude this module.

### Information society 722 (INY 722)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 1 or Semester 2

#### Module content

This module evaluates approaches to and concepts of the information/knowledge society. It questions the origins and political motives for the promotion of an information/knowledge society, and examines a number of relevant themes in the literature.

### Competitive intelligence (I) 726 (INY 726)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 1

#### Module content

Establishing an effective competitive intelligence programme is an integral part of every enterprise that wants to survive in the new millennium. This module focuses on the competitive nature of the business environment, the aim of competitive intelligence, Porter's Competitive Forces Model, the distinction between competitive intelligence and industrial espionage, the intelligence process as well as the tools and techniques for the development and implementation of a competitive intelligence programme.

### Competitive intelligence (II) 727 (INY 727)

<b>Module credits</b>	15.00
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<b>Prerequisites</b>	INY 726
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 2

#### Module content

Competitive intelligence (CI) provides the decision maker with analysed information about the competitive environment, aimed at satisfying decision-making needs. This module focuses on the role of analysis in the intelligence cycle, applying analysis techniques to a case study, CI and corporate governance, the setting up of a CI capability in an organisation and the problems facing CI professionals in South Africa.

### Information communication 730 (INY 730)

<b>Module credits</b>	15.00
<b>Service modules</b>	Faculty of Economic and Management Sciences
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Information Science
<b>Period of presentation</b>	Semester 1 or Semester 2

#### Module content

Informed by the participatory approach to communication this module reflects in depth on methods for the effective communication of information. In order to achieve this, the nature on information within the context on Information Science will be investigated. Thereafter, communication media will be identified and discussed and students will learn how to create a target audience profile to determine the appropriate media and content for the dissemination of information.

Information and communication technologies (ICTs) and the communication of information will be investigated along with literacy and media literacy. The communication of information will form a central focus of this module. Therefore the role of traditional, interpersonal, as well as modern media will be addressed. The processes of creating meaningful and effective messages for the communication of information as well as intercultural communication will also be addressed.

### Capita selecta 716 (INF 716)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Informatics
<b>Period of presentation</b>	Semester 1 or Semester 2

## Module content

This module will be used to present special, relevant topics within the expertise of the department.

### Computer and information security (I) 720 (COS 720)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

## Module content

This module focuses on state-of-the-art security topics that are current and relevant to industry. The curriculum for the module is determined annually to reflect the current research directions as pursued by the information and Computer Security Architectures (ICSA) research group. The main topics include, but are not limited to: Applied security, including operating system security, secure coding, and cryptography; Trust and trust management systems; Privacy and privacy-enhanced technologies; Social Engineering. Students will be challenged to contribute innovative research ideas in the field of Computer Security by completing a number of mini projects such as writing research papers and writing software programs.

### Software engineering (I) 730 (COS 730)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

## Module content

This module covers various perspectives of Software Engineering theory and practices. It provides an overview both of the challenges in contemporary software engineering (such as scale, complexity and urgency) and of the recommended practices for overcoming these challenges. It will familiarise students with both the historical and current theories about activities for the design, development, deployment and ongoing operation of software. It will show how these activities aim to be predictable, repeatable, robust, value-producing, and how they aim to meet the specified requirements for the intended system users. It will also emphasise that standardisation and reuse can be important factors in successfully engineering software. The module assumes prior knowledge about Software Engineering at the level of an introductory/undergraduate module.

### Software engineering (II) 731 (COS 731)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week



<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

### Module content

This module discusses software architecture, including the representation of designs, definitions, styles and patterns of architecture. Its themes include model-driven architecture, formal modelling and analysis, and architectural description languages. The module will show that the architecture of a software system is determined by the collection of significant design decisions made early on in the development of that system – decisions concerning the components comprising the system, repeating-patterns of system-wide aspects, and the platforms on which the system will be built. It will discuss how, once these decisions are made and subsequently followed, they end up profoundly affecting the development, deployment, use and ongoing enhancement of that system. The module assumes that the student is familiar with software development lifecycle concepts, and that she/he has been part of at least one significant software development effort. Those who have not completed COS730 will be provided additional background.

## Formal aspects of computing (I) 740 (COS 740)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

### Module content

The focus of this module is on a formal approach to deriving algorithms, known as “correctness by construction”. It relies on Dijkstra's guarded command language (GCL) for specifying the derived algorithms. The requirements of an algorithm are initially stated in terms of a pre- and a post-condition, specified in first order predicate logic. Strategies are given for progressively refining these specifications to GCL notation which can, in turn, easily be translated into a conventional programming language. The surprising power of the method will be demonstrated. Not only are algorithms guaranteed to be correct (in the same sense that the proof of a mathematical theorem is guaranteed to be correct); they frequently turn out to be remarkably efficient. In the early part of the module, a number of well-known algorithms (such as linear and binary search, raising a number to an integer power, finding the approximate log of a number, etc) will be derived in order to become thoroughly familiar with the approach. Later various intermediate level algorithms will be derived (such as simple raster drawing algorithms, pattern matching algorithms, finding the longest string of a certain type, an algorithm to solve the majority voting problem, etc). Finally, the method will be used to derive state-of-the-art algorithms to minimize finite automata and to construct formal concept lattices. The theory necessary to understand these topics will be provided. The value-objectives of the module are: to develop an appreciation that theory can be effectively deployed to solve practical problems; to value the elegance of the algorithmic solutions; and to value a correctness-by-construction mindset over one that is content with debugging into correctness. A basic understanding is assumed of first order predicate logic, as well as competency in mathematical reasoning.

## Formal aspects of computing (II) 741 (COS 741)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

### Module content

The status of Computer Science, including software science, as a proper “science” is closely related with our ability to construct accurate and precise models of the structures and processes of computational systems. The precision of these models is closely related with our ability to express them in formal notations with mathematical rigour, such that it also becomes possible to reason formally about relevant and interesting properties of these models. Examples of such interesting properties are logical consistency (i.e. absence of inherent contradictions), or safety properties such as deadlock freeness. This module focuses on formal languages and techniques which are suitable for such purposes. Of particular importance are process algebras with which systems of parallel and concurrent computation can be formally described. Other suitable formalisms may be discussed as well, such that the contents of this module may slightly vary from year to year.

## Educational software development 750 (COS 750)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

### Module content

This module provides the foundation to evaluate and develop educational software. It will introduce didactic principles applicable to the discipline of Computer Science. Using these principles, educational software, such as tools for teaching programming, on-line testing software, and adaptive software to name a few, can be evaluated and developed. Computer Science topics of interest are: programming environments, persistence of information and knowledge, knowledge representation etc.

## Data mining 781 (COS 781)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science

**Period of presentation** Semester 1 or Semester 2

### Module content

Data mining is the extraction of novel knowledge, or hidden patterns, from large data bases. The focus of this course is on how the computational intelligence techniques (such as evolutionary algorithms, swarm algorithms and neural networks) can be used for knowledge extraction. In addition, traditional machine learning techniques (such as decision trees and rule induction) will be covered. The pre-processing of data in preparation for data mining algorithms, as well as the post-processing of results after data mining, will be discussed. Exploratory data analysis and statistical data mining methods are also investigated. Finally, some attention will be given to more modern problems, such as the extraction of hidden knowledge from unstructured data, such as text and images. It is highly recommended that students do COS710 and COS711, as knowledge of these modules are assumed.

## Generic programming 782 (COS 782)

**Module credits** 15.00

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** English

**Academic organisation** Computer Science

**Period of presentation** Semester 1 or Semester 2

### Module content

This module introduces the concepts of generic programming in order to generate code at compile-time. Of particular interest is the automatic generation of design pattern implementations at compile-time for use at run-time. To this end, design patterns and compile-time programming techniques such as: basic compile-time programming constructs, object allocation, generalised functors, smart pointer and multi-methods are discussed in detail and applied to design patterns.

## Digital forensics and investigations 783 (COS 783)

**Module credits** 15.00

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** English

**Academic organisation** Computer Science

**Period of presentation** Semester 1 or Semester 2

## Module content

This module will teach the basic theoretical concepts of digital forensic investigations. This module is designed to prepare a student for a wide range of people including, but not limited to, law enforcers, crime investigators and people responsible for internal incident investigations in larger organisations. Digital forensics is a relatively new and upcoming field. It is a field that is not well known by most organisations and therefore, such organisations are ill informed about the digital forensic processes required to conduct a successful digital forensic investigation. The large number of digital devices used to commit crimes or other related incidents, such as fraud and corruption, proved motivation for this module in order to investigate and combat these incidents successfully. The main topics covered, but not limited to, include: An introduction to Digital Forensics; Digital forensic processes; Hardware forensics; Digital forensics tools (software forensics); Forensic readiness; A digital forensics laboratory/facility; Network forensics; Live forensics; Professionalism and ethics in digital forensics; Cyber forensics; Cyber law. Students will be challenged to contribute innovative research ideas in the field of Digital Forensics by completing a number of mini projects such as writing research papers and writing software programs.

## Computer networks 784 (COS 784)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

## Module content

This module covers computer networking principles and the operation of the TCP/IP protocol suite. The module includes studying the operation of relevant protocols, administration of network services, troubleshooting, as well as network design issues and challenges. Prior knowledge is assumed on basic data communications principles, the ISO OSI reference model, and the basic operation of protocols in the TCP/IP protocol suite.

## Parallel and distributed computing 786 (COS 786)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

## Module content

Computational science relies on the analysis of often complex models, for its empirical data and analyses typically involve an enormous amount of calculations. Parallel computing is one means of reducing the time needed to complete such calculations. This module will examine the kinds of problems that lend themselves to parallel computation and the methods for implementing programs to solve such problems. The aim of the module is to provide a background for parallel and distributed computing as well as practical knowledge of the implementation of computational experiments.

### Spatial databases 787 (COS 787)

<b>Module credits</b>	15.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Computer Science
<b>Period of presentation</b>	Semester 1 or Semester 2

## Module content

This module covers the major themes of spatial databases with application to geographic information systems (GIS), i.e. systems concerning data with an implicit or explicit reference to a location relative to the earth. Topics covered include an introduction to spatial databases and spatial data management systems, representation of geographic data, spatial data modelling, computational geometry, spatial data indexing, query processing and spatial data standards. For Computer Science students the module is an introduction to the ever increasing application field of geographics information systems (GIS), and for Geoinformatics students the module provides insight into the Computer Science foundations of the field.

The information published here is subject to change and may be amended after the publication of this information. The [General Regulations \(G Regulations\)](#) apply to all faculties of the University of Pretoria. It is expected of students to familiarise themselves well with these regulations as well as with the information contained in the [General Rules](#) section. Ignorance concerning these regulations and rules will not be accepted as an excuse for any transgression.