



UNIVERSITY
OF
JOHANNESBURG

**ACADEMY OF COMPUTER SCIENCE
AND SOFTWARE ENGINEERING**

HONOURS 2015

COURSE CONTENTS

ENQUIRIES

**Ms S Msibi or Ms T Ferreira
Tel: 011 559 2839 / 011 559 2967
Fax: 011 559 2138**

simangelem@uj.ac.za / tferreira@uj.ac.za

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GENERAL INFORMATION

1. To be admitted to the honours course you must have an average of at least 60% in your final study year for Computer Science / Informatics. **Please take note that only a limited number of students will be allowed to register for some of the courses as indicated in this brochure.**

2. HONOURS DEGREE IN INFORMATION TECHNOLOGY (HBS310)

This degree is accredited by the British Computer Society since 2006. This accreditation is only valid for students who obtained the accredited BSC310/ BSIT01 degree.

The Honours Degree in Information Technology consists of SEVEN semester modules AND a compulsory practical year project that counts as 3 modules.

The following core semester module is compulsory:

- Ethical and legal aspects of Information Technology (IT00247/ IT28X47)

The scope of the compulsory practical year project is a minimum of 200 hours. The year project spans two consecutive semester courses. The continuation of the project in the second semester is dependent on satisfactory progress during the first semester. The project must be developed strictly according to the project development methodology as prescribed by the Academy of Computer Science and Software Engineering. To be accredited by the BCS students must pass the project the first time.

Rules of Access:

- A BSC310 / BSIT01 Degree from the University of Johannesburg.
- An average mark of at least 60% in Computer Science or Informatics in the final year.

3. HONOURS IN COMPUTER SCIENCE / INFORMATICS (HBS012; HBS008; H2C07Q)

A HBS012, HBS008 or H2C07Q degree consists of nine semester modules which include the following compulsory module:

- Ethical & Legal Aspects of Information Technology (IT00247/ IT28X47)

4. The first meeting for **all honours students** will be in **January 2015** at **17:30**. It is important that all prospective honours students attend this meeting as the lecturers for all honours courses will be available for questions.
5. Registration will take place in **January 2015**. The final date will be published as soon as it is available.
6. Students must make sure that all problems concerning their subject choices are solved before registration **because students are not allowed to change any subjects OR register for new subjects after the first Friday in 2015 for the first semester**. Students may however still cancel subjects.
7. If a student registers for a specific module and **does not attend the first 25% of lectures**, his/her **registration will be cancelled**.
8. The regulations concerning honours degrees within the Academy of Computer Science and Software Engineering and the Faculty of Science at the University of Johannesburg states that: upon the third occurrence of receiving a failing final grade for any Honours module a student will be awarded an F7 global result and will no longer be allowed to continue further studies within the Academy of Computer Science and Software Engineering or the Faculty of Science.
9. Lectures will start on **Monday, 2 February 2015** as scheduled on the time table.

10. Some of the courses will be presented during the day time. Part-time students must make sure that it is possible for them to attend lectures as scheduled as there will be no duplication of lectures after hours.
11. It is compulsory to attend all lectures in all the courses.
12. There will be no meeting on the first day of the second semester. Lectures will start on **Monday, 13 July 2015** as scheduled.
13. The timetable for 2015 will be available at the end of November 2014.

FIRST SEMESTER

IT00230 PROJECT (3 MODULES)
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- **This project is compulsory for only HBS310 (BSc Honours in Information Technology) students.**
- **This project is a one year project and counts as 3 modules.**

Brief outline:

The year project spans two consecutive semesters. The continuation of the project in the second semester is dependent on satisfactory progress during the first semester. The project must be developed strictly according to the project development methodology as prescribed by the Academy of Computer Science and Software Engineering.

Students are required to provide 9 deliverables, namely:

1. Draft proposal
2. Project proposal deliverable
3. Preliminary design review
4. Detailed design review
5. Deployment and prototype system
6. Development of alpha version
7. Development of beta version
8. Critique of project
9. Demonstration of final fully operational system and final project document

Purpose of the module:

The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise to develop and implement a working IT system.

The main objective of this module is to allow the student to research and develop a programmable project in a wide variety of fields endorsed by the lecturers in the University of Johannesburg's Academy of Computer Science and Software Engineering, thereby enriching and opening job opportunities in the specialised research field. The module is designed to give students more freedom in the choice of their research topic. The module also includes a critique of the project, where students are expected to critically evaluate the project developed.

Learning outcomes:

At the end of this module students will be able to:

- Draft a project proposal for a software system in a specialized field.
- Produce a revised project proposal deliverable after completion of further research and collaboration with a study leader.
- Research and evaluate existing solutions and prepare a preliminary design using appropriate design techniques.
- Produce a detailed design using relevant design techniques
- Produce a deployment strategy for the system and produce a live prototype of the system

- Develop an alpha version of a software system.
- Develop a beta version of a software system.
- Critically evaluate their software system.
- Demonstrate and discuss the final fully operational system in a live environment.

IT00287 PROJECT (2 MODULES)

➤ **This project is a one year project and counts as 2 modules.**

Brief outline:

The year project spans two consecutive semesters. The continuation of the project in the second semester is dependent on satisfactory progress during the first semester. The project must be developed strictly according to the project development methodology as prescribed by the Academy of Computer Science and Software Engineering.

Students are required to provide 8 deliverables, namely:

1. Draft proposal
2. Project proposal deliverable
3. Preliminary design review
4. Detailed design review
5. Deployment and prototype system
6. Development of alpha version
7. Development of beta version
8. Demonstration of final fully operational system and final project document

Purpose of the module:

The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise to develop and implement a working IT system.

The objective of this module is to allow the student to research and develop a programmable project in a wide variety of fields endorsed by the lecturers in the University of Johannesburg's Academy of Computer Science and Software Engineering, thereby enriching and opening job opportunities in the specialised research field. The module is designed to give students more freedom in the choice of their research topic.

Learning outcomes:

At the end of this module students will be able to:

- Draft a project proposal for a software system in a specialized field.
- Produce a revised project proposal deliverable after completion of further research and collaboration with a study leader.
- Research and evaluate existing solutions and prepare a preliminary design using appropriate design techniques.
- Produce a detailed design using relevant design techniques
- Produce a deployment strategy for the system and produce a live prototype of the system
- Develop an alpha version of a software system.

- Develop a beta version of a software system.
- Demonstrate and discuss the final fully operational system in a live environment.

IT00027/ IT08X27 COMPUTER FORENSICS

Brief outline:

This one semester module considers the aspects related to Computer Forensics and Incident Response:

- Digital Evidence and Computer Crime
- History and Terminology of Computer Crime Investigation
- Technology and Law
- The Investigative Process
- Investigative Reconstruction
- Computer Basics for Digital Investigators
- Applying Forensic Science to Windows Systems
- Forensic Examination of Windows Systems
- Applying Forensic Science to Networks
- Digital Evidence on the Internet
- Investigating Computer Intrusions
- Digital Evidence as Alibi
- Handling the Digital Crime Scene
- Digital Evidence Examination Guidelines

Purpose of the module:

The Computer Forensics module teaches students the basic terminology and legal aspects as they pertain to a computer forensic investigation. Furthermore the procedure that must be followed in an investigation is described in detail as well as practically demonstrated. Computer forensics therefore contributes to the program by allowing students to further specialise their knowledge in information security, particularly in computer forensics and digital investigations.

Learning outcomes:

At the end of this module students will be able to:

- Discuss the role of the digital investigator.
- Identify key aspects of digital evidence and computer crime
- Discuss the relative aspects of the law as it applies to digital investigations.
- Demonstrate the ability to undertake a digital investigation by following a set investigative process.
- Apply the necessary skills to manage, organize and deliver digital forensic research results individually and/or in a team relation.

- This course will be offered in a block of 3 days from 08:00 – 15:00 during the first semester.

Brief outline:

- Introduction to Information Security.
- Overview of the five Security Pillars:
 1. Identification and Authentication
 - Passwords
 - Tokens
 - Biometrics
 - Multi-Modal approaches
 2. Integrity
 - MD5, SSH Algorithms
 - MAC
 3. Confidentiality
 - EAS
 - DES
 - Anonymity
 4. Authorization
 - Discretionary mechanisms
 - Mandatory Mechanisms
 - Bell & Lapadula
 - Military model
 - Kerberos
 5. Non Repudiation
 - PKI
 - CA
 - Introduction to Information Security Management

Purpose of the module:

The aim of this module is to introduce students to the concepts relating to information security and to the technical aspects of information security with specific reference to the five security pillars as one of the basic components of the IT profession. Furthermore students will be instructed on how to use the five security pillars to ensure that information is safe guarded. The inner workings of Identification & Authentication, Integrity, Confidentiality, Non-Repudiation, and Authorization will be discussed.

Students will also be introduced to aspects of Information Security Management, including international best practices for Information Security Management

Learning outcomes:

At the end of this module students will be able to:

- Indicate and explain the importance of securing information using the five information security pillars, as well as the impact on the market.
- Demonstrate the various techniques needed to enforce Confidentiality.
- Demonstrate the various techniques needed to enforce Integrity

- Demonstrate the various techniques needed to enforce Authorization
- Demonstrate the various techniques needed to enforce Non-Repudiation
- Demonstrate an understanding of Information security Management
- Research of various topics relating to information security.

IT00077/ IT08X77 INTRODUCTION TO IT PROJECT MANAGEMENT
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Brief outline:

The module is presented in 10 sections during the course of one semester:

- Introduction & IT Context
- Process groups & Integration Management
- Scope Management
- Time Management
- Cost Management
- Quality Management
- HR Management
- Communication Management
- Risk Management
- Procurement Management

Purpose of the module:

This module exposes students to the discipline of IT project management. By looking at all the areas involved in IT project management, a holistic view can be formed. The idea is not to make students into project managers at the end of the module, but rather for the student to have an appreciation for the discipline and understand the mechanics involved. This will be helpful in fulfilling the role of a team member working on an IT project or in leading or managing a project.

Learning outcomes:

At the end of this module students will be able to:

- Apply the theoretical principles of problem identification and solving in the field of Information Technology project management
- Plan and execute research in relevant fields in IT project management.
- Demonstrate communication competence with different role players
- Accountably develop macro vision of Information Technology Project Management
- Effectively organise and co-ordinate resources and opportunities
- Practice social sensitivity in the relationships with others in self-directed teams
- Utilise appropriate Information Technology systems effectively in the project management environment

Brief outline:

- Compiler components
- Lexical analysis
- Syntax analysis
- Semantic analysis
- Abstract parse trees and the symbol table
- Intermediate code generation
- Basic blocks and traces
- Instruction selection
- Liveness analysis
- Register allocation and graph colouring
- Garbage collection
- Object orientation
- Optimisation

Purpose of the module:

The goal of this module is to empower the student to be able to understand and apply the building blocks of Compiler Construction. The module is designed to use well-established techniques to construct compilers. These techniques also form the basis of programs in a number of related Information Technologies fields, such as text processing.

Learning outcomes:

After the module the student will be able to:

- Design a simple programming language using a suitable notation.
- Implement a lexical analyser, parser and semantic analyser.
- Describe error detection and recovery strategies.
- Discuss machine code generation.
- Discuss modern compiler features such as garbage collection and optimisation.

- **Prerequisite: Knowledge of a suitable programming language is required as practical work will entail the implementation of an intelligent agent-based system.**

Brief outline:

Students are introduced to the principles, concepts and a number of sub-disciplines of Artificial Intelligence. Concepts include agents, search strategies, state spaces and knowledge representation. Sub-disciplines may include one or more of the following: agent technology, robotics, machine learning, computer vision, multi-agent systems, and natural language understanding, planning, AI and education, reasoning under uncertainty, intelligent technologies for information retrieval and knowledge mining.

Important concepts for implementing AI systems will be studied and a number of fields in AI will also be discussed. Subjects include:

- Introduction to Artificial Intelligence
- Intelligent Agents
- Problem solving: - Searching, Informed Search, Constraint Satisfaction Problems, Adversarial Search.
- Logical Agents
- Philosophical Foundations of Agents
- Overview of the current state of the art.
- One or more specialized AI topics.

Purpose of the module:

The module introduces students to important concepts for implementing Artificial Intelligence in Information Technology systems. A number of fields in Artificial Intelligence will also be discussed.

Learning outcomes:

At the end of this module students will be able to:

- Discuss what Artificial Intelligence is and the role of Artificial Intelligence in Information Technology and society as a whole.
- Describe the concepts and theories related to Artificial Intelligence.
- Research, design and implement an intelligent agent-based system.
- Identify the components needed for an intelligent agent-based system.
- Demonstrate exposure to Artificial Intelligence principles.
- Apply skills to manage, organize and deliver research results.

IT00117/ IT18X17 FUNCTIONAL PROGRAMMING

Brief outline:

Functional programming is an approach to programming where computation is treated as the evaluation of mathematical functions. A key aspect of functional languages is that they avoid side effects (such as state and mutable data). Functional languages make extensive mechanisms such as recursion in order to evaluate functions. This family of languages is becoming more commonplace in mainstream software development because the resulting software can be highly-scalable, modular, dynamic, and can be proved correct.

Purpose of the module:

To enable to the learner to formulate and apply functional solutions as opposed to the conventional imperative solutions. A functional solution often simplifies the task of proof of correctness of a program and is thus of great value to the industry. The course challenges the learner to solve problems in new ways, providing further new tools and experience of problem solving.

Learning outcomes:

At the end of this module students will:

- Recognise the fundamental differences between functional and imperative programming languages.
- Demonstrate their knowledge of functional languages by writing short programs to solve problems using a functional language.
- Research and develop new algorithms in a functional language to solve problems efficiently.
- Design these algorithms by choosing the appropriate data structures for implementing a solution.
- Critique on the efficiency of algorithms in a functional language.

IT00197/ IT18X97 PARALLEL PROGRAMMING

Brief outline:

A parallel computer contains two or more processors which can be used together to solve a problem. In this module, the architecture of parallel systems and the design of parallel Algorithms are studied.

In particular the following themes are covered:

- Motivation of parallel computing
- History of parallel architecture
- Design of parallel algorithms
- The MPI (Message Passing Interface) library
- The analysis of several well studied and documented parallel algorithms, including but not limited to the analysis of parallel algorithm performance.

Purpose of the module:

The primary of the module as an integral part of the BSc Honours (Information Technology) programme is to develop Information Technology professionals with parallel programming expertise as part of the IT discipline in South Africa.

The main objective of this module is to empower the student to be able to understand the architecture and advantages of distributed and parallel computer systems. The objective includes empowering the student to design and implement parallel algorithms.

Learning outcome:

At the end of this module students will be able to:

- Differentiate between distributed and parallel computing.
- Describe the different parallel architectures.
- Apply performance measures to parallel algorithms.
- Critique on the different message passing models.
- Develop parallel algorithms for a multicomputer.
- Evaluate the efficacy and efficiency of the proposed parallel programming solution.

Brief outline:

This course focuses on the IT aspects of Knowledge Management (KM) highlighting the following points:

- Why KM?
- What KM entails; and
- IT aspects that focus on:
 - The principles of KM;
 - KM technologies and systems;
 - The application and future of KM;

As a practical semester project, students also develop a practical understanding of the application of KM using a set of tools, by developing an IT policy and defining KM metrics to define maturity and success.

Purpose of the module:

This course in the IT aspects of knowledge management aims to introduce students to the theory and practice behind the information and communication technologies used to support knowledge management.

Learning outcomes:

At the end of this module students will be able to:

- Discuss what knowledge management is as well as the role of knowledge management systems in the organization and society as a whole.
- Describe the fundamental concepts and theories related to the Information Technology aspects of Knowledge Management Systems.
- Research and design a knowledge management strategy and system with emphasis on the role of technology and tools in the knowledge management process.
- Identify the key components needed for a knowledge management solution.
- Demonstrate they have the required knowledge, skills and attitudes that will allow them to operate effectively as a member of a knowledge management team.
- Demonstrate a sufficient exposure to selected management principles that will facilitate the establishment of a knowledge management program in an organisation.
- Apply the necessary skills to manage, organize and deliver research results individually and/or in a team relation

Brief outline:

The module is presented in a number of units during the course of the semester. The following may be covered:

- The development of an IS/IT Strategy.
- Strategic planning for e-business organisations.
- Strategic management of the applications portfolio.
- Managing IT as an investment.

Purpose of the module:

The objective of this module is to allow the student to be able to understand the main building blocks of the development and implementation of electronic commerce strategies which forms an important part of Information Technology strategies.

Learning outcomes:

After the module the student will be able to:

- Describe the concept of e-business.
- Explain strategic planning for e-business organizations.
- Appreciate the role of managing IT as an investment.
- Describe the importance of the strategic management of the applications for e-business organizations.
- Research and develop an IS/IT strategy for e-business organizations.

IT00297/ IT28X97 DATA COMMUNICATIONS
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➤ **Because of physical limitations, only 30 students will be allowed to do this course.**

Brief outline:

The Module is presented covering the following sections during the course of one semester:

- Duties of the System Administrator
- Planning a Network
- Installation
- File systems
- Configuration files
- TCP/IP networking
- The Network file system
- Connecting to Microsoft networks
- Optimizing network services
- LDAP
- DNS
- Mail
- FTP
- Web
- Optimizing Internet Services
- Upgrading the Kernel
- Configuring the system from the command line
- Administering Users and Groups
- Installing and upgrading software packages
- Backing up and restoring file system
- Security Basics
- Implementing Local Security
- Implementing Network Security
- Detecting and preventing intrusions
- Troubleshooting and problem solving

Purpose of the module:

The module enables students to explain data communications concepts and the components of the Internet and Intranets. Each service available on the Internet/Intranet is studied and practical sessions allow the student to install, configure, secure and study how each service works. A practical problem solving session is also integrated to empower the student to identify and correct fault. The student then has to apply the knowledge with a practical semester project that addresses data communication issues related to IT.

Learning outcomes:

At the end of this module students will be able to:

- Install and configure basic network facilities in the concerned operating system.
- Configure routers.
- Install and configure several network services.
- Diagnose network problems.
- Independently research and implement a network service or combination of services.
- Explain the operation of a service or combination of services

IT00301/ IT08X31 SERVICES COMPUTING

Brief outline:

The module is presented in a number of units during the course of the semester. The following may be covered:

- XML technologies.
- Service interfaces.
- Messaging.
- Service publication.
- Service composition.
- Non-functional requirements and capabilities of services.
- Security and related standards.
- Additional topic such as mobile web services, Grid computing and autonomic computing.

Purpose of the module:

The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise in web services.

Service-oriented architecture (SOA) presents an approach for building distributed systems that deliver application functionality as services to either end-user applications or other services. Web services are a technology that is well suited to implementing a service-oriented architecture. This module will give students the knowledge, understanding and skill to implement SOAs with web services technology.

Learning outcomes:

At the end of this module students will be able to:

- Describe the contemporary concept of service-oriented architecture.
- Explain the principles of service-oriented design.
- Apply the principles of service-oriented design to service-oriented applications.
- Integrate extended web services specifications into service-oriented applications.

- Apply extended web services specifications in complex service-oriented applications.
- Use appropriate technologies to implement service-oriented applications

For more information on this module, go to the Subjects link at:

https://sites.google.com/site/marijkecoetzee/services_computing

SECOND SEMESTER

IT00247/ IT28X47 ETHICAL AND LEGAL ASPECTS OF IT
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Brief outline:

Ethical

- basic concepts in IT ethics
- moral analysis and decision making in IT ethical situations
- strategies for dealing with IT moral dilemmas
- the role of professional codes of conduct in IT

Legal

- Legal aspects of information and communication technology
- the socio-economic impact of IT law
- E-Commerce law

Purpose of the module:

Ethical

- This module in IT ethics is designed to create awareness of the ethical dimension of IT and to prepare students to manage this dimension effectively as there is a wide consensus that rapid developments in IT have outstripped our human capacity to deal responsibly with these developments. Thus it is alleged that there exists a moral vacuum in cyberspace.

Legal

- The module is also aimed at gaining an understanding of legal challenges in the IT field and why traditional mechanisms of law creation are, and will increasingly be, rigorously challenged.

Learning outcomes:

At the end of this module students will be able to:

- Define ethics and its importance in the IT industry.
- Identify moral dilemmas and apply the R.I.M.S. Strategy for moral decision making.
- Identification and distinction between the two main forms of ethical codes.
- Understanding of the Law of Copyright, Trademarks and Contracts.

IT00037/ IT08X37 SYSTEMS PROGRAMMING
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Brief outline:

The course covers the design and implementation of a device driver, or the modification of the OS kernel to accomplish some new functionality. The Linux Kernel is used to illustrate the concepts of device drivers in a POSIX-compliant operating system.

Purpose of the module:

To enable the learner to understand the implementation issues surrounding Operating Systems and the implementation of concepts relating to Operating Systems. To allow the learner to write software that operate at kernel level, and to write software that interacts with this kernel level software.

Learning outcomes:

At the end of this module students will be able to:

- Recognise the different architectures used in an operating system.
- Explain several of the key components of an operating system.
- Demonstrate an understanding of the internal workings of an operating system by writing programs that interact with the operating system.
- Develop a device driver or modify an operating system to support new features.
- Critique on their device driver, including design and engineering choices.

IT00057/ IT08X57 INFORMATION SECURITY IN WWW
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➤ **Prerequisite:** IT00047/ IT08X47 Information Security is a prerequisite for this course.

Brief outline:

This module is being revamped in 2014. The Art of War (Sun Tzu) prescribes that possessing knowledge of the enemy is vital to a successful outcome in battle. In the module Information Security in the WWW, you will not only learn of appropriate countermeasures that can (and should) be used in defending various aspects of the WWW against threat actors, but gain insight into the methods that these very threat actors employ to subvert WWW systems.

Purpose of the module:

The aim of this module is to introduce students to Information Security concepts that relate to securing networked and Internet-facing information systems, as well as other socio-technical systems. Students will be introduced to the fundamentals of defensive security as well as techniques for bypassing information security processes in an effort to recognize and counteract the threats.

Learning outcomes:

At the end of this module students will be able to:

- Assess and measure threats to information assets.
- Evaluate where information networks are most vulnerable.
- Critique and propose security plans designed at protecting information systems against attacks
- Perform penetration tests into networks for evaluation purposes.
- Develop an ongoing security strategy.
- Discuss the legal implications of ethical security circumvention.

IT00137/ IT18X37 MOBILE PROGRAMMING

Brief outline:

The Module is presented covering the following sections during the course of one semester.

- Introduction to mobile applications.
- Overview of the Java 2 Micro Edition Platform.
 - Connected Limited Device Configuration (CLDC)
 - Libraries
 - Mobile Information Device Profile (MIDP)

- Application Model
- User Interface
- Game API
- Sound API
- Persistence Libraries
- Networking and Serial Communications
- Event Driven Application Launch.
- Security for MIDlet suites.
- MIDlet Deployment

Purpose of the module:

The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with mobile programming experience. The aim of this module is to introduce students to mobile application architecture and development with the Java 2 Micro Edition and the technical aspects of the Connected, Limited Device Configuration (CLDC) version 1.1 and Mobile Information Device Profile (MIDP) version 2.0. Furthermore, the module aims to instruct students on how to use the CLDC and MIDP for application development and how mobile applications are deployed to target devices.

Learning outcomes:

At the end of this module students will be able to:

- Indicate the importance of mobile application infrastructure and technology as well as the impact on the market.
- Describe and utilize the architecture of Java 2 Micro-Edition compliant devices.
- Demonstrate a thorough grasp of the MIDP Application Model.
- Discuss the use of various User Interface options available for application development in MIDP.
- Demonstrate a thorough understanding of the following the MIDP API's.
- Discuss Event Driven Application Launch.
- Demonstrate a thorough knowledge of the Security model for MIDlet suites.
- Discuss and explain MIDlet Deployment using Over-the-Air (OTA) Provisioning.

IT00147/ IT18X47 NETWORK INFORMATION SECURITY

➤ **Prerequisite:** IT00047/ IT08X47 Information Security is a prerequisite for this course.

Brief outline:

This module examines security of wireless networks such as wireless LANs, mobile ad hoc networks, and wireless mesh networks. The module will first present on overview of wireless networks, then focus on threats; discuss proposed solutions and their limitations.

Topics can include Wireless hardware and protocols, cracking WEP, wireless attacks, WPA, 802.11x, hotspot security, virtual private networks, intrusion detection systems, Bluetooth security, MANET security challenges and solutions

Purpose of the module:

The primary purpose of this module is to provide IT professionals who are competent in network information security. The module enabled the student to explain wireless security concepts and design decisions. The student should be able to evaluate the weaknesses and strengths of current standards and non-standardised techniques. Throughout the course the security implications are discussed for both wireless environments and wired environments that are wirelessly enabled.

Learning outcomes:

At the end of this module students will be able to:

- Explain the foundations of wireless networks.
- Describe the functions of the different types of wireless LAN hardware.
- Describe the basic principles of security design.
- Explain wireless network security protections, principles, models and vulnerabilities.
- Explain future trends in wireless networks and their security.
- Appraise current or future trends in wireless networks.

IT00157/ IT18X57 ADVANCED ARTIFICIAL INTELLIGENCE

➤ **Prerequisite:** IT00097/ IT08X97 Artificial Intelligence is a prerequisite for this course

Brief outline:

The module is presented during the course of one semester and includes the concepts and principles of one or more specializations in Artificial Intelligence. For each topic, the following are discussed:

- Concepts
- Research questions
- Current state of the art

Specific topics will be one or more of the following:

- Robotics
- Planning
- Natural Language Processing
- Computer Vision
- Semantic Web
- Learning
- Knowledge Representation
- Application of AI techniques in application areas.

Purpose of the module:

The module introduces students to important concepts of one or more specializations in the field of Artificial Intelligence and the importance of these to Information Technology.

Learning outcomes:

At the end of this module students will be able to:

- Discuss specializations in Artificial Intelligence and the relevance of the above in Artificial Intelligence and Information Technology as a whole.
- Describe the fundamental concepts and theories related to the specializations of Artificial Intelligence.
- Research and report on open questions in Artificial Intelligence in any specialization.
- Demonstrate an exposure to Artificial Intelligence principles.
- Apply skills to manage, organize and deliver research results.

IT00177/ IT18X77 GRAPHICS

Brief outline:

- Vectors, points, lines and polygons
- Transformations
- Rasterisation
- Lighting, illumination and shading
- Averaging and interpolation
- Texture mapping
- Colour representation
- Bezier curves
- Ray tracing
- Intersection testing
- Radiosity
- Photon mapping
- Animation

Purpose of the module:

This module will enable the student to write software to realistically render three-dimensional representations of scenes. In addition it will enable the student to decide which computer graphics rendering algorithms are appropriate for a particular problem, enabling skills associated with Information Technology problem solving.

Learning outcomes:

After the module the student will be able to:

- Develop a program to represent a scene.
- Develop a program that renders a scene.
- Apply transforms including rotations translations and projections for a given problem.
- Apply lighting models in theory and in a project.
- Explain the use of texturing.
- Describe global illumination techniques.
- Evaluate curves.

Brief outline:

The module will concentrate on one or more selected emerging technologies and techniques for developing software systems. Topics may include one or more of the following:

- Multi-agent systems;
- Artificial societies;
- Simulated organisations;
- Agent intelligence; and
- Data mining.
- Service oriented architectures;
- Extreme programming;
- Intelligent technologies for requirement specifications;
- Rational unified process; and
- Aspect-based software engineering.

This module must be seen as highly topical and research-based. Students will be expected to apply these methodologies to a practical example project of their choice.

Purpose of the module:

The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals who can identify, evaluate and solve problems associated with the Information Technology discipline in South Africa as well as in the international context. Through the acquisition of appropriate competence and research ability they will be able to enter into a range of professional and entrepreneurial opportunities in Information Technology. The module focuses on one or more selected emerging technologies and techniques for developing software systems.

Learning outcomes:

At the end of this module students will be able to:

- Discuss emerging technologies and techniques for developing software systems.
- Describe the fundamental concepts and theories related to emerging technologies.
- Research and report on the application of emerging technologies on a software system of their choice.
- Demonstrate a sufficient exposure to emerging technologies and techniques for developing software systems.
- Apply the necessary skills to manage, organize and deliver research results individually and/or in a team relation.

➤ **Prerequisite:** IT00047/ IT08X47 Information Security is a prerequisite for this course.

Brief outline:

- Introduction to Biometrics.
- Overview of generic Biometric systems.
- Fingerprint Biometrics
- Hand Biometrics
- Iris and Retina Biometrics
- Key stroke dynamics
- Voice and Face Biometrics
- Esoteric Biometrics
- Facial Thermography
- Biological Signals
- Liveness testing
- Biometrics in large systems
- Political, ethical and religious concerns of Biometrics

Purpose of the module:

Biometrics is an important field in establishing secure Information Technology systems. The aim of this module is to introduce students to strong authentication technologies by utilizing Biometrics. It introduces students to the technical aspects of the various Biometric approaches and instructs students on how to use Biometrics for various levels of secure Authentication.

Learning outcomes:

At the end of this module students will be able to:

- Indicate and discuss the importance of Biometric application infrastructure and technology as well as the impact on the market.
- Discuss the architecture of a generic Biometric system.
- Demonstrate knowledge of various Biometric Models.
- Demonstrate knowledge of using Liveness testing to facilitate authentic measurement of biometric subjects.
- Demonstrate knowledge of Biometrics used in large systems
- Demonstrate knowledge of concerns relating to biometrics in political, ethical and religious areas.
- Implement a working Biometric system.

➤ **Prerequisite:** IT00047/ IT08X47 Information Security is a prerequisite for this course.

Brief outline:

To address the key subjects, the course consists of the following:

- The OCTAVE risk management approach
- The OCTAVE principles, attributes, and outputs
- The OCTAVE method and phases
- Tailoring the OCTAVE approach

Purpose of the module:

The module in Information Security Risk Analysis will show students how to use cost-effective risk analysis techniques to identify and quantify the threats—both accidental and purposeful—that an organization faces. The module steps you through the qualitative risk analysis process using techniques such as PARA (Practical Application of Risk Analysis) and FRAP (Facilitated Risk Analysis Process). This module furthers the students' knowledge of Information Security Risk Analysis contributing to the students' development as an IT professional.

Learning outcomes:

At the end of this module students will be able to:

- Discuss the role of risk management and the risk management process in an organisation.
- Identify key aspects of risk management.
- Undertake a risk management analysis by following a set risk management process.
- Apply risk management analysis and implementation thereof in the various organisational environments

Brief outline:

This module is being revamped and will include handling BIG DATA.

Purpose of the module:

This module serves to enable the student to understand the implementation of solutions to issues related to Big Data. The focus will be on the implementation of Advanced Big Data Management and Analytics Mechanisms. This will allow the student to deploy Big Data Infrastructure and write software that interacts with these data stores to extract useful information from them.

Learning outcomes:

At the end of this module students will be able to:

- Articulate the challenges and opportunities faced by Data Scientists and organizations in an era of Big Data.
- Explain the computational complexity placed on algorithms and data structures as a result of Big Data requirements.
- Deploy leading edge Big Data infrastructure and provision data in them.
- Implement and execute big data analytics algorithms on Big Data.
- Disseminate information extracted from performing Big Data analytics.

IT00269/ IT28X69 ADVANCED INFORMATION TECHNOLOGY PROJECT MANAGEMENT

- **Prerequisite:** IT00077/ IT08X77 Introduction to IT Project Management is a prerequisite for this course

Brief outline:

The module is presented in 8 sections during the course of one semester

- Quality Management: CMMI
- Project Management as a Profession
- Negotiation Techniques
- Supplier Management
- Diversity in the South African context
- The role of personal networking in career management
- The role of Web 2.0 technologies in project communication management
- An in-depth look at critical chain project scheduling

Purpose of the module:

The module also enables the student to investigate Information Technology areas of the Project Management Body of Knowledge in more detail and to augment the student's understanding by introducing concepts from other management disciplines.

Learning outcomes:

- Apply the CMMI to the improvement of project quality.
- Understand what it means to be a professional and how it applies to his or her role as a project manager.
- Apply negotiation techniques to real-world situations.
- Discuss supplier management and how it applies to project management.
- Appreciate the subtleties of our multi-cultural society as well as the role of women therein.
- Explain why personal networking is important in the modern workplace.
- Propose how modern Web 2.0 technologies can be used in project communications management.

IT00280/ IT28X80 INFORMATION SECURITY GOVERNANCE
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- **This course will be offered in a block of 3 days from 08:00 – 15:00 during the second semester.**
- **Prerequisite:** IT00047/ IT08X47 Information Security are a prerequisite for this course.

Brief outline:

The following topics will be discussed:

- Corporate Governance (CG)
- Information Technology Governance (ITG)
- Information Security Governance (ISG)
- International Best Practices for CG, ITG, ISG

- A Model for ISG
- The components of the model
- Policies
- Compliance
- Organization
- Risk Management
- Awareness
- Implementing an ISG plan

Purpose of the module:

The module serves to introduce the student to the fundamental and best practice aspects of Information Security Governance. The student is introduced to theoretical, technical, practical and international best practice considerations of good Information Security Governance, as a vital component of Information Technology.

Learning outcomes:

After completion of the module the student will be able to:

- Appraise the paradigm of ISG
- Discuss the importance of best practices in ISG
- Analyse the components of a good ISG plan
- Assess the process to implement a good ISG plan and formulate such a plan.

IT00300/ IT08X30 SOFTWARE FACTORIES

- **Prerequisite:** IT00077/ IT08X77 Introduction to IT Project Management is a prerequisite for this course.

Brief outline:

Software Factories specialize in producing software by applying manufacturing techniques and principles to Software Development. A Software Factory takes advantage of specialization, reduced handoffs and standardized processes that enables repeatable and cumulative success.

Purpose of the module:

This module exposes the student to the implementation and day-to-day operation of a large scale software development facility. Themes from software development, software engineering and other disciplines will be covered.

Learning outcomes:

After completion of the module the student will be able to:

- Understand the technical aspects of software delivery.
- Understand the management aspects of software delivery.
- Appreciate the personal disciplines needed to achieve higher levels of professionalism and productivity.
- Appreciate the role complexity and the effect thereof on delivery.
- Understand how a manage different stakeholders.
- Explain how to affect change indifferent settings.

➤ **Prerequisite:** IT00047/ IT08X47 Information Security is a prerequisite for this course.

Brief outline:

The role of Critical Information Infrastructure Protection (CIIP) in the modern world is becoming an integral part of any IT system. Furthermore, the role of CIIP, the effects of cyber attack, and the implications of computer security incidents on IT systems must be understood to be effectively counteracted. Many critical systems are used in a country's national infrastructure and as such, CIIP plays an increasingly important role in protecting these systems.

Purpose of the module:

This module exposes the student to the concepts relating to Critical Information Infrastructure Protection (CIIP) and the role CIIP plays in IT Systems. This module will include discussions on the effects of cyber-threats on IT and critical systems, and associated methods to protect these systems. Furthermore other themes relating to critical information infrastructures will be discussed.

Learning outcomes:

After completion of this learning event, the student should be able to:

- Understand the technical aspects of Critical Information Infrastructure Protection.
- Understand what constitutes a critical information infrastructure.
- Understand what constitutes a critical system.
- Understand the methods and models of protecting critical information infrastructures.
- Discuss the threats which are associated critical information infrastructures.
- Explain the role critical information infrastructures plays in critical systems.

