

## University of Wollongong, Australia

### Bachelor of Computer Science (Digital Systems Security)

#### **Networks and Communications**

This subject introduces students to the fundamentals of data communications and computer networks. Topics covered include: different types of data and the history of data communications; signals; modulation and multiplexing, switching and routing, network architectures: LANs, WANs and the Internet; Internet services and protocols; and emerging topics. The subject explains computer networking models that interconnect diverse communication systems, including the ISO reference model and the TCP/IP protocol Suite.

#### **Introduction to Web Technology**

This subject introduces students to fundamental web technologies that underlie the World Wide Web and its commercial applications. Topics include an overview of internet communications, an introduction to the web-browser/web-server client-server systems, HTML5/CSS/XHTML/XML markup languages, web forms and client side scripting. Students will build working web-sites with dynamic content. The subject explains the differences between client-side and server-side Web development, and demonstrates how to build simple applications using scripting and other tools. The subject also covers current Web “standards” and future W3C recommendations.

#### **Programming Fundamentals**

The broad aim of this subject is to develop in students an understanding of the fundamental principles of programming. The subject focusses on the object oriented view of problem analysis and solving. It enables students to develop skills in the design and implementation of well structured programs in a range of domains.

#### **System Analysis**

This subject provides an introduction to different techniques and technologies for understanding and specifying what a computer based information system should accomplish. It examines the complementary roles of systems analysts, clients and users in a system development life cycle. Students will learn different fact-finding techniques to elicit system requirements and how to develop business models, data and process models, and object models representing a system. Students will also make use of a Computer Aided Software Engineering (CASE) tool to build those models that capture the specifications of a system.

#### **Data Management and Security**

The subject investigates three major areas of modern data management systems: data modelling, data processing, and data security. The goal of the subject is to learn the fundamental concepts in data management including conceptual modelling, the relational data model, processing of relational data with Structured Query Language (SQL), enforcing the concepts of data confidentiality, integrity, and availability data management systems. The subject develops the skills in the design, implementation, processing, and security of data management systems. The subject covers the following topics in data security: discretionary access control, user management, enforcing data security and integrity. The subject also explains the important ethical issues associated with responsible disclosure, responsibility, liability, security weaknesses, and privacy in data management systems.

## **Problem Solving**

This subject introduces the analysis of problems and the strategies used to manage them, primarily in the context of computing. Problem classification is introduced, as are formal and informal approaches to problem solving. The importance of method and method classification for problem solving strategies is motivated, and the need to compare and analyse strategies is justified. Introductory tools for the analysis of strategies are covered. Appropriate representations for problem solving are explored.

## **Object Oriented Design and Programming**

**Pre-requisites: Programming Fundamentals**

The aims of this subject are to consolidate and extend student's knowledge and skills in structured programming and to develop their understanding and practice of object oriented programming. To achieve this aim the subject will provide students with an opportunity to develop further programming skills and good coding style; develop skills in using the object oriented concepts of encapsulation, inheritance, polymorphism, access control, overloading and messaging; develop and display competency in the design and implementation of object oriented programs to solve business problems.

## **Fundamental Programming with Python**

This module uses Python language to introduce students with fundamental programming concepts such as procedural programming, variable, data type, array, recursive function, conditional expression, selection statement, repeating instruction. It also develops student skills in the design and implementation of well structured algorithms to a range of mathematical problems.

## **IT Project Management**

**Pre-requisites: System Analysis**

The primary aim of this subject is to acquaint students with the methodologies and processes associated with the task of managing information technology and software development projects. Topics may include: stakeholder and impact analysis, setting project objectives and conflict resolution, project planning and the selection of appropriate project approaches, software project effort estimation, cost-benefit analysis, activity planning and scheduling, risk management, contract management, quality assurance, professional and ethical responsibilities, and case studies.

## **Human Computer Interaction**

The subject provides students with an understanding of Human Computer Interaction (HCI) principles and practices, and how to apply them in the context of developing usable interactive computer applications and systems. The subject also emphasises the importance of taking into account contextual, organisational, and social factors in the design of computer systems. Students will be taken through the analysis, design, development, and evaluation of user interfaces. They will acquire hands-on design skills through an interaction design project. The subject will cover topics including user-centred design, the development process, prototyping, usability testing, measuring and evaluating the user experience and accessibility.

## **Software Development Methodologies**

**Pre-requisites: IT Project Management + 18 credit points @ 200 level**

The subject introduces to students modern methodologies for software development. Topics may include software development life cycle activities, the role of software process models, different types of evolutionary models, Unified Process and UML, agile principles of software development, Dynamic Systems Development Method (DSDM), Scrum and extreme programming, test driven software development, the Capability Maturity Model Integration (CMMI), software engineering knowledge management, software architecture, and emerging trends in software development processes.

## **Project**

**Pre-requisites: IT Project Management + 18 credit points @ 200 level**

This subject is the capstone project for students in Computer Science and Information Technology it aims to provide students with: practical experience in complete systems development. The projects connect groups of students with supervisors and clients that are facing an ICT-based problem for which the students are required to find innovative and creative solutions. Working in groups, students design, implement, and document a system. This involves: project planning and scheduling, seminars and individual presentations, group coordination, research of proposed application domain, use of design methodologies, design documentation, coding, module and system integration, testing, verification, and implementation. Teams will meet weekly with supervisors to discuss progress and problems.

## **Algorithms and Data Structures**

**Pre-requisites: Fundamental Programming with Python or Programming Fundamentals + Problem Solving**

Approaches to analysing algorithm complexity, introduced in first year subjects, will be reviewed. The use of abstract data types as a design technique, and their implementation in solutions to problems, will form a large part of the subject. The concept of efficient code and ways to measure efficiency (both empirically, by timings, and theoretically) will be studied.

## **Database Systems**

**Pre-requisites: Programming Fundamentals + Data Management & Security + 18 credit points 100 level**

This subject investigates the major areas of modern database systems: 1. Design and programming of relational databases 2. Design and programming of semistructured databases (XML native database systems) 3. Design and programming of distributed database systems (NoSQL database systems) 4. Concurrency control and data recovery in database systems. The following topics are included: Introduction to conceptual modelling; Principles of relational database model; Processing relational databases with Structured Query Language (SQL) and its procedural extension (PL/SQL); Principles of semistructured database model; Processing of semistructured databases with XQuery and XPath; Design and implementation of distributed database systems; normalisation of relational databases; Transaction management and recovery in database systems.

## **Mathematics for Computer Science**

MATH221 delivers core skills required for learning in computer science. Such skills include logic, formal proof, formal data structures and relations between these data structures. Realised mathematically as sets, bijections, equivalence classes, and graphs, MATH221 gives students hands-on experience with basic mathematical manipulations of these structures, as well as an exposition on their most fundamental properties.

## **Advanced Programming**

**Pre-requisites:** Object Oriented Design & Programming

The subject develops a thorough understanding of programming features, which are implemented in the C++ programming language. It comprises of four main components, namely procedural-based, object-based, object-oriented and generic programming. The subject addresses topics including memory management issues and dynamic memory allocation; classes; STL sequential and associative containers; operator overloading; advanced features in object-oriented programming; C++ RTTI; templates and exception handling; the latest C++ features (e.g. C++11 and C++14 standards).

## **Principles of eBusiness**

This subject aims to provide students with an understanding of eBusiness fundamentals. Today most businesses compete in a global environment and a sound strategy for online business is essential to facilitate this. This subject covers key areas of eBusiness, including: business-to-consumer, business-to-business and business-to-government electronic commerce (EC); online business models and electronic payment systems (EPS) and EC technology basics. Standards, regulation and policy, security and social and economic issues will also be considered in the contexts of business Intranets, Extranets and the Internet. The subject also provides an introduction to the 'Patterns for eBusiness' approach to eBusiness analysis and design.

## **Mathematics for Information Technology**

MATH223 is a core subject for information technology students, providing key mathematical and statistical knowledge. The subject is split into two strands: the Calculus Strand and the Data Analysis Strand. Calculus Strand This strand begins by reviewing mathematical principles and tools that support analysis in the IT workplace, including algebraic concepts, summation, polynomials, integrals, derivatives, and special functions (exp, log, trig). The material is applied to understand essential concepts in mathematical finance. The strand concludes with project evaluation techniques, such as return-on-investment. Data Analysis Strand The second part of MATH223 builds on the core calculus concepts developed above with discrete and continuous probability. The strand begins with basic data analysis, including univariate and bivariate of data, association, correlation, and introductory regression. Study continues with discrete probability models (binomial) and continuous distributions, including the normal and uniform distributions. The subject ends with hypothesis testing, such as Chi-squared and the Central Limit Theorem.

## **Management Information Systems**

This subject introduces students to an overview of all the major Information Systems found in a typical business covering systems such as finance, HR, payroll, inventory, sales, CRM, SCM and ERP. Students will be introduced to the processes involved in managing information systems in the contemporary business environment. Students will gain an appreciation of the issues surrounding the strategy and planning of information systems; the strategic, tactical and operational roles of the Chief Information Officer (CIO); the alignment between information systems and business; policy and practice; technology diffusion; operational management; major trends impacting information systems management and how to assess the value of information systems.

## **Knowledge and Information Engineering**

**Pre-requisites:** Introduction to Web Technology

This subject explores issues in using IT to support knowledge sharing and reuse. Challenges in representing and sharing knowledge in the context of deploying knowledge systems are studied. Additional challenges in heterogeneous IT environments are also examined. The subject presents systematic approaches for knowledge engineering via a contemporary Web and modern information modelling approach. The appropriate application

environments, acquisition tools and representation schemes for content management are examined along with their relationship to contemporary issues in Web technology.

## **Introduction to Management**

Wherever organisations exist, a manager's role emerges. Organisations rely on managers and the management function for the efficient and effective running of their operations. This subject will introduce students to the various functions involved in managing, as well as the context of management: the organisation. Students will learn key management theories and concepts including organisational culture, social responsibility and ethics, managing groups, motivating employees, planning, managing human resources and employment relations, strategic management, decision-making, supply chain and operations management, leadership and foundations of management control. Students will learn how the different interests between organisational stakeholders affect various management processes, and the implications of managerial decisions on the internal and external environments.

## **Systems Security**

The subject covers some fundamental computer security technologies in the following aspects: (1) Operating system security such as physical security, file protections, system abuses, attacks and protections; (2) Database security including data integrity, data recover, data encryption/ decryption, access control, and authentication; (3) Mobile code security including malicious logic, host and mobile code protection, mobile agents' security. (4) Intrusion detection; (5) Security policies; (6) Security management and risk analysis.

## **Cryptography and Secure Applications**

This subject develops the skills and knowledge necessary to identify and address security problems in a variety of simple communication models. Topics covered include: Classical cryptology, Modern secret key cryptography including block (DES, AES) and stream ciphers (RC4), security properties (authentication, integrity, confidentiality, availability), public key cryptography (knapsacks, RSA, Rabin, Elgamal), digital signatures (RSA, DSS, Elgamal), hashing (birthday paradox, Merkle-Damgard construction), MACS's, Key management (PKI, certificates, key establishment/exchange/transport, Diffie-Hellman), Identification protocols, Privacy preserving (mix-nets), Secret sharing. Applications studied include some of: email security, SET, E-payment, E-voting, Fair exchange.

## **Network Security**

This subject provides a survey of network security technologies, and explores them in practice. This includes but is not limited to, network-based threats, security failure in cryptographic and network protocols, authentication servers, certificates and public-key infrastructures, security provisions in communication protocols and standards, electronic mail security, firewalls and intrusion detection systems.

## **Distributed Systems and Cloud Computing**

This subject introduces basic concepts underlying modern distributed system and cloud computing system design. The subject provides some experience in the implementation of distributed system and cloud computing system components. A particular focus of this subject is on scalability, transparency, and design principles underlying distributed and cloud computing systems. Topics covered include: inter-process communications, multi-threaded servers, remote-procedure-calls, synchronous and asynchronous RPC, client server systems, distributed system architectures, messaging and transactional systems, peer-to-peer, cluster, and grid technologies, virtualization and fault tolerance, synchronization, security, naming, synchronization, replication, and consistency; supporting systems

such as NFS, and DNS, with some practical exposure to real world distributed systems, design of distributed file services or distributed web based services, and cloud computing systems.

### **3D Modelling and Animation**

This subject provides students with a hands-on introduction to the use of computers for developing models of three-dimensional objects and viewing them in 3D as still images and animations. Topics covered include basic modelling primitives, from polygons to spline surfaces; tools to modify simple objects; surfacing concepts such as textures and bump maps; basic lighting of scenes; the animation process including key frames, articulated structures, camera movement and morphing; lighting effects such as volumetrics and radiosity. The subject uses the industry standard software package LightWave.

### **Interactive Computer Graphics**

Introduction to computer representation of lines and points; mathematical models; transformations in 2 and 3 dimensions; homogenous coordinate systems; fill algorithms; solid modelling; hidden line and surface algorithms; lighting models; and current trends.

### **Game Engine Essentials**

This subject will introduce fundamental concepts and techniques required in the development of games and game engines. Game engine components that will be examined include rendering, collision and physics, artificial intelligence among others. The design and development of these components will be illustrated using appropriate software and application programming interfaces. Among others, topics covered in this subject will include game loops and time management, handling input, cameras, particles, collision detection, rigid-body dynamics, terrain, path-finding, and state machines.

### **Multicore and GPU Programming**

This subject introduces the topic of heterogeneous computing by examining the development of software on modern computing systems that are often equipped with more than one kind of processor. Students will learn to use appropriate programming interfaces to design and implement programs for computing systems incorporating multicore CPU and GPU hardware. Among others, topics covered will include parallel programming, data management, execution and memory models, parallel patterns, performance considerations, and current trends.

### **Business Process Management**

Business process management (BPM) combines a process-centric and cross-functional approach to improving how organizations achieve their business goals. A BPM solution makes use of IT to model, automate, manage and optimize business processes to increase productivity. Within this subject students learn important process-centric issues in business system design and implementation. Focus will be placed on both business and technical perspectives of BPM. Topics covered include: Basic business process concepts; Business process modelling; Business process outsourcing; Business process re-engineering; Business process improvement; Workflow and business process automation; Business process management and service-oriented architecture.

## **Strategic eBusiness Solutions**

This subject aims to provide students with an understanding of how to design integrated solutions for eBusiness using a pattern-oriented approach. Enterprises, both large and small, as well as government institutions, are increasingly becoming reliant upon eBusiness infrastructure. Knowing the strategic business and technology principles and practices related to the design process is becoming increasingly important for a given organisation. This subject will cover business scenarios including electronic data interchange (EDI), supply chain management (SCM), enterprise application integration (EAI), customer relationship management (CRM), sales force automation (SFA); and knowledge management systems (KM).

## **Frontend Web Programming**

**Pre-requisites: Programming Fundamentals + Introduction to Web Technology**

The subject provides students with a practical knowledge of web programming concepts and techniques and user interface design techniques used in the creation of dynamic web sites. The subject will provide students with an opportunity to develop an understanding of the principles of client and server-based scripts as well as user-interface constructs. Students will also be able to apply these principles. The subject provides an in-depth look at the object-oriented features of web programming. Students will have exposure to appropriate software development tools to complete a data cycle of input data –store data –output data via the web.

## **Backend Web Programming**

**Pre-requisites: Programming Fundamentals + Introduction to Web Technology + 18 credit points @ 200 level**

The subject aims to integrate the previous knowledge which students have gained through subjects on web technologies, web programming and databases to create real-world web applications like shopping carts or advanced form processing systems etc. It also introduces students to open-source programming languages in web development so that they can inexpensively develop sophisticated web applications. Students will become familiar with the integration of programming, databases, web-applications, and structural and object oriented programming.

## **Big Data Management**

**Pre-requisites: Data Management & Security + 24 credit points @ 100 level**

The subject addresses the problems of managing and processing of extremely large data sets in a single-server centralized computing systems and in multi-server clustered and distributed computing systems. The topics related to processing of large data sets in centralized environments include the techniques based on the classical data warehouse technologies such multidimensional data model, data warehouse architecture, data warehouse design both at conceptual and logical levels, and data warehouse processing with appropriate specialised query operations. The topics related to processing of large data sets in distributed environments include the techniques that can be implemented on the clusters of inexpensive computing nodes using MapReduce programming model. The subject introduces the students to the real time analytical processing of large data sets with analytical cluster-based distributed data processing systems. Discussion and hands on exercises related to these topics will equip students to meet the challenges in Big Data environments and appreciate the added challenges of dealing with unstructured data. Students will be presented with opportunities to do hands-on work with appropriate commercial tools.

## **Database Performance Tuning**

The subject addresses the problems related to performance of relational database systems. In its introductory part, the subject presents an internal architecture of relational database servers and typically available performance measurement and performance tuning software tools. Two groups of solutions are investigated: structural and operational. The structural solutions presented in the subject include denormalization of relational tables, indexing, clustering, partitioning, and creation of materialized views. The operational solutions presented in the subject include application of specialized SQL to performance tuning, optimization of SQL and PL/SQL, application of cost-based optimizations, and performance tuning through modification of parameters of relational database server.

## **Data Mining and Knowledge Discovery**

Introduction to Data Mining, Knowledge Discovery, and Big Data with coverage of Data Structures, role of Data Quality and pre-processing, Association Rules, Artificial Neural Networks, Support Vector methods, Tree Based Methods, Clustering and Classification Methods, Regression and Statistical Methods, Overfitting and Inferential issues, Evaluation, Use of Data Mining packages with applications for benchmark and real world situations.

## **Mobile Multimedia**

The subject will introduce the acquisition, representation, compression, transportation/communication and consumption of multimedia data including, images, video and audio. The treatment will be general and cover commonly used acquisition devices including digital still and video cameras, audio microphones; colour representation techniques for images and video; modern compression techniques for compact representation (JPEG, JPEG2000, H.264/AVC, MPEG4.); RTSP, etc. The subject will include a laboratory component where students design and implement simple applications of multimedia including computer games.

## **Accounting Fundamentals in Society**

This subject introduces the role of accounting information in society including its social and ethical aspects relating to both the individual and the organisation. The subject introduces basic accounting language, concepts and techniques to identify, classify, process, record and present accounting and financial information. The subject also considers accounting information that can be used for making decisions about past and future economic events in a variety of business and social settings.

## **Accounting In Organisations**

The subject advances understanding of accounting in organisations. The subject introduces accounting for complex equity structures, and develops the theoretical and technical aspects of accounting for assets and the protection of assets through internal controls. Accounting for the past and future is examined through the introduction of cost structures and their application in solving fundamental business problems using cost-volume profit analysis. The application of budgets is explored.

## **Statistics for Business**

The aim of the subject is to introduce students to quantitative techniques and their application to the business world with an emphasis on the decision-making process. The main focus of the subject is business statistics and topics will include descriptive statistics, probability, sampling, confidence intervals, hypothesis testing, elementary correlation, regression analysis and time series forecasting. Students are also introduced to the use of computer programs for estimation and analysis to improve business decision-making.



## **Economic Essentials for Business**

This subject introduces students to essential macroeconomic and microeconomic ideas, models and reasoning. This economic knowledge is used to explore important questions such as, is economics a value free science?, do individuals behave rationally?, how and why do market structures vary across different industries and why is this knowledge important?, do markets ever fail, and if so, why?, what are some causes and implications of inflation and unemployment?, how do monetary and financial systems operate?, and how do governments typically respond to domestic macroeconomic volatility? While these questions will not be fully answered in this introductory subject, policy challenges and case studies will be used to demonstrate the importance of basic economic reasoning if sensible answers to economic and social challenges are to be found, and to stimulate greater awareness of economic approaches to the analysis of contemporary social issues.

## **Marketing Principles**

Marketing is a set of activities and processes for creating, communicating and delivering offerings and facilitating satisfying exchange relationships in a way that delivers value for consumers and society. Organisations need to know how to define and segment a market and how to position themselves strongly by identifying marketing opportunities and problems, and developing products, services, experiences and ideas for chosen target markets more effectively than their competitors. Marketing is essential for all organisations including manufacturers, wholesalers, retailers, professional services firms including lawyers, accountants and architects, and non-profit institutions including charities and museums. The subject examines the fundamental concepts underpinning the marketing process and theories relevant to the study and practice of marketing. It serves as a foundation for further studies in business by developing an overview of where marketing fits within organisations and what framework marketing provides for enhancing and enabling the conduct of a business.

## **Business Communications**

This subject introduces the theory and practice of communication in business and in workplaces. It offers knowledge and information on how students can become more effective by becoming culturally sensitive and humane communicators, both personally and professionally, in a range of multimodal environments. It examines and discusses the cultural, organisational and personal contexts and processes of communication, including groups, meetings, interviews, public speaking, presentations and writing. Other issues discussed include interpersonal skills, understandings of non-verbal messages, listening practices and building relationships in business and workplaces.

## **Managing Human Resources**

This subject is concerned with the concepts, techniques and activities involved in managing the flow of people through work organisations. Emphasis is placed on understanding the techniques of contemporary HRM that can be applied in organisations to facilitate the acquisition and development of staff, to influence positively their job performance, and to manage the processes of staff turnover and retention.

## **Organisational Analysis**

This subject examines the key theoretical frames that are used to analyse complex organisations. Students are provided with an understanding of theories and concepts that explain how organisational members are affected by organisational structures and environments, human resource flows, politics, and microcultures. Emphasis is placed on frame complementarity and learning how to apply the frames to real organisations.

## **Organisational Behaviour**

The subject examines aspects of the social and behavioural sciences that are relevant to understanding human behaviour in work organisations. The focus of the subject ranges from the behaviour and activities of individuals and groups in organisational settings, to understanding complex organisations as a whole.

## **Management of Change**

This subject deals with management of change in organisations. Topics include: sources of change, resistance to change, coping with change, organisational values, creation of organisational visions and missions, leading organisational change, models of organisational change, creation and change of organisational cultures. Emphasis is placed on the application of theory to case study examples.

## TEACH OUT MODULES

### YEAR 1

#### **CSCI102 Systems**

This subject establishes the position of Computer Science and Information Technology in a non-programming context. Areas introduced include Human-Computer Interface, Information Modelling, Intelligent Systems, Networks, Operating Systems, Software Design and Development and Professional ethics, rights and responsibilities.

#### **ECTE182 Internet Technology**

This subject introduces students to the fundamentals of computer communications. These fundamentals are then used to outline the Internet Architecture, and describe its key components. Following this, the operation of the World Wide Web (WWW) will be detailed. Topics covered include packet switching, switched networks, layered protocols, Local and Wide Area networks, WWW operation, network components (e.g., routers), access technologies (e.g., modems). Laboratory exercises will illustrate key computer communications concepts.

#### **CSCI110 Introduction to W3 Technologies**

This subject introduces the technologies that underlie the World Wide Web and its commercial applications. Topics include an overview of internet communications covering basic protocols such as TCP/IP and HTTP, an introduction to the web-browser/web-server client-server systems, HTML/XHTML/XML markup languages, web forms, client side scripting technologies, basics of relational databases, and server side scripting languages. Students will build working web-sites with dynamic content. Working in groups, students will explore the uses of one or more of the more elaborate framework applications for web-based collaboration (Web-2 technologies).

#### **STAT131 Understanding Variation and Uncertainty**

Variation and uncertainty occur in most aspects of life. Students will learn about techniques, concepts and theory which assist in making sense of this variability and uncertainty through three major components; Exploring Variation in Data; Modelling Uncertainty; Estimation and Hypothesis Testing.

#### **MATH121 Discrete Mathematics**

Students will be introduced to the spirit of mathematical inquiry and critical analysis, and encouraged to develop the ability to apply mathematical principles to the formulation and solution of problems. This is done through the use of non-calculus techniques, especially those of logic and number theory.

#### **CSCI103 Algorithms and Problem Solving**

This subject introduces the basic concepts of algorithms and their relationship to data structures and problem solving. This subject emphasises problem solving techniques leading to the development of algorithms rather than their implementation or

a formal mathematical treatment of algorithms. Topics include sorting, searching and counting problems and the principal algorithms used in their solution. Common approaches to algorithm development and analysis will be examined.

### **CSCI114 Procedural Programming**

This subject introduces the procedural approach to programme design and implementation. Covers basic language constructs for defining variables of built-in types, flow control constructs and simple I/O. Explores functional decomposition as a design technique, and the implementation of functions. Introduces simple user-defined data types and aggregates.

### **CSCI124 Applied Programming**

**Pre-Requisites: CSCI103 & CSCI114**

This subject develops a thorough understanding of programme design using data structures. It extends CSCI114 and presents pointers, dynamic memory management and exception handling. Other topics include implementation of Sorting and Searching Algorithms including the use of typedefs, void pointers and indexes to generalise algorithms; Implementation of data structures: queues, stacks, linked lists, dequeues, trees; Use of arrays as an implementation structure – hashing, radix sort, heaps and Heapsort; Random Access files and internal I/O; Testing of programmes: black and white box testing, and the use of debuggers; Use of multi-file organisation in encapsulation and data hiding, with make files; These concepts will be treated through formal lectures, tutorials, assignments and laboratory sessions employing an object oriented language.

## **YEAR 2**

### **CSCI203 Algorithms and Data Structures**

**Pre-requisites: CSCI124**

Approaches to analysing algorithm complexity. The use of abstract data types as a design technique, and their implementation in solutions to problems, will form a large part of the subject. The concept of efficient code and ways to measure efficiency (both empirically, by timings, and theoretically) will be studied.

### **IACT201 Professional Practice and Ethics**

This subject will examine the information technology industry which encompasses: telecommunications; computing; broadcasting and publishing. It will analyse the encroachment of industry activities that use electronic media on: citizens' rights in matters of data surveillance; freedom of access to information and ownership of intellectual property. The extent to which technical solutions to these problems can and cannot be provided will be discussed and alternative non-technical solutions will also be treated. An investigation of the current legal safeguards, their legislative histories and the need for new legislation will be covered.

### **CSCI205 Software Development Methods and Tools**

**Pre-requisites: CSCI124**

This subject provides an introduction to the process of design and analysis of software. Students will receive a formal introduction to the software design process and techniques, pattern design and reuse, as well as general approaches of interface design. A UML supporting tool will be used for practice of object oriented development approach.

1. Explain the techniques and stages of a selected modern analysis and design method.
2. Describe the range of application domains to which a method can properly be applied.
3. Demonstrate proficiency in the correct use of the techniques learnt.
4. Properly apply the method to a particular analysis and design problem within the methods application domain.
5. Correctly use UML notation to document the analysis and design.

### **CSCI213 Java Programming and Applications**

**Pre-requisites: CSCI124**

An introduction to the Java language and some of its standard class libraries; and Experience with object oriented design and implementation techniques. Topics covered will include: use of a Java Integrated Development Environment, Java language, subset of the standard Java class packages (Standard Edition: windowing, graphics, TCP/IP networking, threads, database access, applet, media), security issues with portable code, Java "Micro Edition" (ME) and its associated packages and applications. Development of applications for different environments.

### **CSCI204 Object and Generic Programming in C++**

**Pre-requisites: CSCI124**

CSCI204 develops a thorough understanding of the object oriented approach and introduces such object concepts as encapsulation, inheritance, polymorphism and runtime binding. This is complemented by an introduction to object-oriented design, with UML representations at the programme level. Templates are introduced as a method of achieving generalisation. Container classes and the Standard Template Library are presented as examples of generic programming.

### **CSCI212 Interacting Systems**

#### **Pre-requisites: CSCI124**

Develops an understanding of the operating system and tools from a programmer's viewpoint. Topics covered include the file system, processes, communication and tools. In particular, access, security, organisation, operating system effect on performance of a programme, support, control; process and interaction, inter-process communication; use of shell scripts and commands to enhance problem solving; tools for development process; programme paradigms; parallel, distributed, etc.

### **CSCI222 Systems Development**

#### **Pre-requisites: CSCI102 & CSCI124**

Provides a framework for understanding and developing the necessary skills to successfully undertake the major third year software project. The emphasis of this subject is on the design and development process and its application to real world problems. The subject combines a formal introduction to the discipline of software engineering with a practical application of its methods.

### **CSCI235 Database Systems**

#### **Pre-requisites: CSCI124**

This subject investigates the major areas of modern database systems:

- Design and programming of relational databases
- Design and programming of semistructured databases (XML native database systems)
- Design and programming of distributed database systems (NoSQL database systems)
- Concurrency control and data recovery in database systems

Topics will include: Introduction to conceptual modelling; Principles of relational database model; Processing relational databases with Structured Query Language (SQL) and its procedural extension (PL/SQL); Principles of semistructured database model; Processing of semistructured databases with Query and XPath; Design and implementation of distributed database systems; normalisation of relational databases; Transaction management and recovery in database systems.

## **YEAR 3**

### **CSCI319 Distributed Systems and Cloud Computing**

#### **Pre-requisites: CSCI124**

This subject introduces basic concepts underlying modern distributed system and cloud computing system design. The subject provides some experience in the implementation of distributed system and cloud computing system components. A particular focus of this subject is on scalability, transparency, and design principles underlying distributed and cloud computing systems. Topics covered include: inter-process communications, multi-threaded servers, remote-procedure-calls, synchronous and asynchronous RPC, client server systems, distributed system architectures, messaging and transactional systems, peer-to-peer, cluster, and grid technologies, virtualization and fault tolerance, synchronization, security, naming, synchronization, replication, and consistency; supporting systems such as NFS, and DNS, with some practical exposure to real world distributed systems, design of distributed file services or distributed web based services, and cloud computing systems.

### **CSCI262 Systems Security**

#### **Pre-requisites: CSCI124**

The subject covers some fundamental computer security technologies in the following aspects:

- Operating system security such as physical security, file protections, system abuses, attacks and protections
- Database security including data integrity, data recover, data encryption/decryption, access control, and authentication
- Mobile code security including malicious logic, host and mobile code protection, mobile agents' security
- Intrusion detection
- Security policies
- Security management and risk analysis

### **CSCI358 Security Engineering**

This subject looks at the design, deployment and governance of secure systems. We begin with a sketch of what security engineering is, and present a basic framework which we use throughout the subject. We give an overview of the technical foundations of information security, specifically confidentiality and integrity mechanisms, access control and authentication. We look at the roles of protocols and the effect of distributed environments. We look at aspects of the design process and governance, including threat modeling and risk analysis. We look at the role and design of standards. We discuss how a diverse range of issues, such as psychology, law, economics and privacy, impinge on the various components of the security

framework. We may consider examples from a range of specific systems, such as banking systems, physical security systems, digital rights management and game security.

### **CSCI361 Cryptography and Secure Applications**

#### **Pre-requisites: CSCI204**

This subject develops the skills and knowledge necessary to identify and address security problems in a variety of simple communication models. Topics covered include: Classical cryptology, Modern secret key cryptography including block (DES, AES) and stream ciphers (RC4), security properties (authentication, integrity, confidentiality, availability), public key cryptography (knapsacks, RSA, Rabin, Elgamal), digital signatures (RSA, DSS, Elgamal), hashing (birthday paradox, Merkle-Damgard construction), MACS's, Key management (PKI, certificates, key establishment/exchange/transport, Diffie-Hellman), Identification protocols, Privacy preserving (mix-nets), Secret sharing. Applications studied include some of: email security, SET, E-payment, E-voting, Fair exchange.

### **CSCI368 Network Security**

This subject provides a survey of network security technologies, and explores them in practice. This includes but is not limited to, network-based threats, security failure in cryptographic and network protocols, authentication servers, certificates and public-key infrastructures, security provisions in communication protocols and standards, electronic mail security, firewalls and intrusion detection systems.

### **CSCI322 Systems Administration**

#### **Pre-requisites: CSCI204 + 6 credit points @ 200 level**

This subject will cover the practical and theoretical aspects of system administration. The various resource areas which have to be managed will be discussed and examined. And the possible methods of monitoring and controlling them in various systems will be investigated. The features unique to both single processor and networked systems will be investigated.

### **CSCI321 Project**

#### **Pre-requisites: CSCI222**

Working in groups, students design, implement, and document a software system. Involves: project planning and scheduling, seminars and individual presentations, group co-ordination, research of proposed application domain, use of design methodologies, design documentation, coding, module and system integration, testing verification, and implementation.