

CORE MODULES: BSc (Hons) Computing and Information Systems

You must take modules worth 120 credits at each level of the course. Each module is worth a specified number of credits.

Year one for full-time students (Level 4)

Systems Design and Development (30 credits)

- This module will introduce students to structured software development involving the systems development lifecycle concept, to include requirements analysis, design methodologies and implementation of a relational database solution with SQL queries to meet a specified user need.*

Programming Concepts (15 credits)

- You will use industry-standard tools and techniques to design, implement, test and document simple programs using a current procedural language such as C#. The module delivers the principal concepts of high-level programming, emphasises good programming practice and supports the techniques required to develop software which is robust, usable and maintainable. Skills developed will be directly transferable to the workplace.*

User Interface Development (15 credits)

- Developing effective human-computer interfaces is a fundamental concern within the software design and development industry. This module aims to introduce learners to the core concepts of interaction design, usability and user experience within the discipline of application development.*

Digital Asset Development (15 credits)

- This module gives learners the opportunity to gain hands-on experience with digital asset creation tools that are commonly used in the software development industry. The skills taught in this module are intended to provide a suitable foundation for learners to enhance the visual impact of independently developed software applications both in their later studies and future career.*

Computer Architecture and Networking (30 credits)

- This module introduces students to the components present in modern computer systems and networks. On completing this module, students will be able to specify, construct and maintain networked computer systems, and gain an in-depth understanding of common computer and network architectures, their function and confidently solve their problems.*

Maths for Computing (15 credits)

- This module aims to provide you with an understanding of the underlying mathematical concepts that support the diverse fields supported by software engineers. The module covers conditional statements, graphics and gaming (geometry and vectors), relationships in databases, methods and procedures, matrices in the handling of arrays, large datasets and mapping, statistics and set theory.*

Year two for full-time students (Level 5)

Advanced Database Design (15 credits)

- This module builds on the fundamentals of database design from Level 4 giving students opportunities to develop an understanding of the concepts and issues relating to databases and database design as well as the practical skills to translate that understanding into the design and creation of complex databases.*

Developing Interactive Web Solutions (15 credits)

- *This module will expose students to client side interactive and dynamic web design techniques. Students will create and analyse web-based solutions using industry standard toolkits and frameworks for example Bootstrap, JQuery, AJAX and Foundation.*

Group Design Project (30 credits)

- *This module introduces you to industry style development by operating in teams of 3 or 4 and delivering a functional project that satisfies the requirements of a client. Students will manage their work as projects using appropriate techniques. You will conduct user requirements analysis and develop designs and software collaboratively getting feedback from the client and responding to changes in requirements.*

Principles of Digital Security (15 credits)

- *This module explores the technology and practices required to provide security in digital systems. The students study programming techniques to defend against attacks such as SQL Injection and buffer overflow, fail-safe, defence-in-depth and least privilege. Encryption algorithms are researched and critically assessed.*

Plus 45 credits of optional modules dependant on pathway

- **OPTIONAL MODULE: Networking Essentials (15 credits)**
This module focuses on the key concepts of network switching and routing. It introduces the learner to converged networks and examines some of the underpinning building blocks of this technology. The module then looks at how networking devices are configured and how the data is switched and subsequently routed between networks. Network security features are also considered. There is a focus on how data can be handled discreetly and more securely by the implementing and configuring Virtual Local Area Networks (VLAN). This knowledge is then extended so the network can be configured to allow inter VLAN routing to take place. The module is delivered as a mixture of theory, delivered through a series of lectures, and practical implementation, delivered through a series of guided laboratory exercises. In the lab sessions students will gain deep understanding on the routing and switching concepts and acquire hands-on-skills using advanced network simulation tools that comply with industry standard router platforms. Students studying this module will be able to access on-line materials including the Cisco Networking Academy online curriculum, the VLE, and access a specialist laboratory. Assessment is by designing and implementing a small network to meet a brief with a report justifying the decisions taken and the functionality achieved.
- **OPTIONAL MODULE: Object Oriented Programme Development (15 credits)**
Object oriented programming is a programming language model organised around objects rather than actions and data rather than logic. Industry dictates that the reuse of code is a fundamental skill required of graduates as this leads to cleaner, more robust code. Object Oriented programming also facilitates the generation of Test Driven Development. The module will expose students to the fundamentals of Object Oriented Program Design and Development. Students will receive a solid understanding of Object Oriented Techniques including Inheritance, Association, Aggregation, Polymorphism and Encapsulation and how these techniques are utilised in a business environment. Design techniques such as CRC cards will aid the creation of software and students will develop Class Diagrams and other UML documentation. Students will gain practical programming knowledge through the development of programs in an object-oriented language such as C# and Java. The learning will be assessed through weekly in-class tasks and by the students writing a program to meet a brief supported by a report justifying their design choices and object-oriented architecture. Delivery of this module will be supported using the Virtual Learning Environment and students will be expected to undertake interactive online activities on a weekly basis to support understanding and to share knowledge.

- **OPTIONAL MODULE: Database Driven Websites (15 credits)**

This module is designed to introduce students to the design, development and implementation of client / server applications for Internet or Intranet web sites. Building on from Introduction to Programming, web pages created with HTML, and scripting languages access a database via SQL statements embedded in appropriate pages. It is expected that students will have a thorough knowledge of HTML, CSS and Scripting languages before beginning this module. Whilst it is necessary that the student deliver a working web site without code errors, it is also a requirement that the design of the pages is user centered. It is considered essential that the student understands the necessity for a web site, whether it is on the Internet or Intranet, to be usable by its clients both internal and external. Additionally, the student is required to produce documentation that fully describes the web site such that others can easily make future revisions. In order to understand the design of client / server web site it is necessary that the student researches current design standards and existing related web sites.

- **OPTIONAL MODULE: Design Patterns for Software Engineering (15 credits)**

Design patterns are commonly defined as time-tested solutions to recurring design problems. The term refers to both the description of a solution that you can read, and an instance of that solution as used to solve a particular problem. Students will be introduced to not only what design patterns are but how and why their use facilitates creation of robust code. The knowledge of modern design patterns has become a key requirement for the employment of software engineering graduates, therefore real-world scenarios will be utilised throughout the module ensuring currency of knowledge. This module provides students with a broad range of accepted design solutions for everyday software problems. Students will select and implement the appropriate design patterns for given scenarios. Key design patterns will be appraised such as Singleton, Factory, Observer and Decorator. Implementation will be via an appropriate object-oriented programming language such as C#. Assessment is through in-class tasks and a final report which might analyse a body of code, identifying the patterns in use and explaining the value of each one. Delivery will be supported using the Virtual Learning Environment and students will be expected to undertake interactive online activities on a weekly basis to support understanding and to share knowledge.

- **OPTIONAL MODULE: E-Commerce and E-Crime (15 credits)**

The connected world is changing, with the widespread use of fast internet connections and the move to online shopping so comes new dangers with online security. With this advent also comes new ways for criminals to use technology to their advantage. This module will introduce students to the concepts of E-Commerce together with an appreciation of E-Crime including how this is employed and how it can be mitigated. Students will be able to evaluate E-Commerce websites for content and security and to identify concepts used to make Ecommerce successful. E-Crime will be assessed and contingency planning considered. Students will consider relevant news articles each week and discuss these in class. Assessment will be through a report critically analysing e-commerce websites and evaluating their commercial success factors and their security.

- **OPTIONAL MODULE: Management of Information Technology (15 credits)**

The effective management of IT necessitates the consideration of an increasingly wide range of both technical and human elements. This module focuses on giving students an understanding of the particular issues and practices involved in the administration and management of enduser support. It will include the key practical aspects of network administration e.g. setting up user rights as well as the management issues concerned with helpdesks, product and service acquisition. Students will be made aware of the need for a problem resolution framework and efficient configuration and infrastructure management procedures. There will also be consideration of the changing nature of the maintenance role and computing job roles in this context and the potential professional implications of these for the future. After consideration of a case study scenario students will be required to produce justified recommendations in a formal written report and be prepared to discuss these at a presentation to a management board.

- **OPTIONAL MODULE: The Mobile Web (15 credits)**

With the advent of cheap tablets and internet enabled smart phones, access to web content is moving away from the traditional desk based to a more mobile consumption of content. This module will build upon previous knowledge gained in Digital Asset Development and highlight the need for mobile solutions. Working with mobile technologies, students will analyse the need for mobile web solutions and will use existing frameworks and new technologies to produce mobile content. This module will also look at the constraints and opportunities when it comes to delivering information in this mobile world. Students will utilise and evaluate a number of technologies to build mobile content including Frameworks such as Bootstrap and Online App Builders such as App Maker. The fundamentals of creating content for the mobile web will also be examined including the way the user interacts with the website and how this differs to desktop use. Web APIs for mobile use will also be explored such as Google Maps API and other Geolocation data. Assessment is by designing, building and demonstrating a website aimed at mobile users and also by a report on techniques for good usability and performance which may be shown by the artefact.

- **OPTIONAL MODULE: Advanced Network Routing (15 credits)**

This module builds on the key concepts of network switching and routing by focusing on routing protocols and some of the more advanced elements of network device configuration. This module introduces the learner to static and dynamic routing theory and the protocols associated with this element of the technology. Open Shortest Path First (OSPF) will be used to create a routed network and further security features such as Access Control Lists (ACL) will be presented. Network addressing features such as Dynamic Host Configuration Protocol (DHCP) and Network Address Translation (NAT) are finally implemented to complete the network configuration. The module is delivered as a mixture of theory, delivered through a series of lectures, and practical implementation, delivered through a series of guided laboratory exercises. In the lab sessions students will gain a deep understanding on the routing and switching concepts and acquire hands-on-skills using advanced network simulation tools that comply with industry standard router platforms. Students studying this module will be able to access on-line materials including the Cisco Networking Academy online curriculum, the VLE, and access a specialist laboratory. Assessment is through a closed book exam and a practical assignment with documentation.

Final year for full-time students (Level 6)

Undergraduate Major Project (30 credits)

- *This module allows students to engage in a substantial piece of individual research and product development work, focused on a topic relevant to computing. The chosen topic will require the student to identify / formulate problems and issues, conduct literature reviews, evaluate information, investigate and adopt suitable development methodologies, determine solutions, develop hardware, software and/or media artefacts as appropriate, process data, critically appraise and present their findings using a variety of media.*

Developing Ethical and Professional Skills (15 credits)

- *As computing now has an impact on everyday life and employment in the developed world, professionals need an understanding of ethics, law and the impact of what they do on society. This module provides an understanding of the issues, opportunities and problems which have arisen as a result of the computerisation of wide areas of human activity.*

Business and Innovation Development (15 credits)

- *You will study the role of emerging technologies in changing markets or creating new markets. You will contrast invention with innovation and examine case studies of innovation in IT to appreciate what decisions lead to success or failure. You will also study the requirements for starting a new business venture, choosing a potential new service or product and delivering a realistic business plan.*

Plus 60 credits of optional modules dependant on pathway

- **OPTIONAL MODULE: Team Based Development (15 credits)**

Developing software as part of a team introduces a host of challenges. A strong, motivated development team working together can marshal the strengths and specialities of each of its members to create something much larger than the sum of its parts. The module will discuss strategies for dealing with conflict, ideas on how to become stronger communicators, and ways to help you and your teammates get the best from one another. This module will develop students knowledge of Team Based Development, enhancing skills learnt in previous programming modules. Students will be introduced to current industry working practices and will use these techniques in a team-based project. Test cases will be developed to enable students to create robust and reliable software. Emphasis will be on Test-Driven Development with responsibility for individual components of a much larger program. Assessment is through designing, testing and contributing a module to a team project and a report appraising the team-based aspects of the process.

- **OPTIONAL MODULE: Artificial Intelligence Programming (15 credits)**

Artificial Intelligence (AI) covers a broad range of disciplines ranging from cognitive science to more pragmatic engineering subjects. It takes its inspiration from human and other biological behaviour that exhibit intelligence, such as problem solving, planning, decision making and optimization, and seeks to create systems that can perform similar intelligent tasks. The students will explore the main areas of AI such as behaviour, genetic algorithms, neural networks and fuzzy logic. The module is quite practical with an emphasis on implementing techniques in code. Some topics will extend over several weeks to allow in-depth study. The module assumes a basic level of mathematical ability and requires students to be familiar with a high-level programming language, such as C#. In the assignment the student will apply AI techniques to a given scenario to demonstrate intelligent behaviour such as decision making, machine learning and optimisation.

- **OPTIONAL MODULE: Big Data and Content Management (15 credits)**

In a knowledge economy, data is probably the most valuable of the non-human enterprise assets. Proper governance of data assets can be a critical success factor since data and information will often outlast the applications it was derived from requiring the management of data and knowledge assets through time as applications, and even business processes change. This module endeavours to provide students with an understanding what big data is, how it is managed and the technologies involved. Assessment: The key element is the design and building of a data warehouse. The student will populate the warehouse and investigate, evaluate and demonstrate techniques to analyse the data in a variety of ways. Module theory is assessed by a report showing how Big Data is managed and used.

- **OPTIONAL MODULE: Network Scaling (15 credits)**

This module is based on the CCNA 3 element of the Cisco Routing & Switching course. It builds on the key concepts of network switching and routing by focusing on the architecture, components, and operations of routers and switches in a larger and more complex network. The student will learn how to configure routers and switches for advanced functionality as well as troubleshoot operational issues with areas such as Dynamic Host Configuration Protocol (DHCP), Domain Name Service (DNS) & Spanning Tree Protocol (STP). The course will look at the operations and benefits of link aggregation and Cisco VLAN Trunk Protocol (VTP) and offer opportunities to compare and troubleshoot both STP & Rapid Spanning Tree Protocol (RSTP) operations. By the end of this module, the student will be able to configure and troubleshoot routers and switches to resolve common issues with Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), STP, and VTP in both IPv4 and IPv6 networks. The module is delivered as a mixture of theory, delivered through a series of lectures, and practical implementation, delivered through a series of guided laboratory exercises. In the lab sessions students will gain deep understanding on the routing and switching concepts and acquire hands-on-skills using advanced network simulation tools that comply with industry standard router platforms. Students studying this module will be able to access on-line materials including the Cisco Networking Academy online curriculum, the VLE, and access a specialist laboratory. Assessment is through a closed-book exam and the demonstration of a network built and documented to suit a given scenario.

- **OPTIONAL MODULE: Mobile Application Development (15 credits)**

Web-based mobile content has its place, however there is also a need for native mobile applications that can offer more functionality and utilise the hardware of the mobile device being used to deliver the content. This module builds on The Mobile Web module and introduces students to the development of native applications on different platforms. Students will utilise development tools and techniques on platforms such as Windows Phone, IOS and Android to create native apps based on real world scenarios. Students will integrate data-driven apps with appropriate databases and third party APIs. The module will also investigate the functionality of the hardware and software used to deliver the app and will utilise this to create user friendly systems. Design guidelines from companies such as Android will be used to develop user-friendly content. Assessment: Students will design, build, test and demonstrate a mobile app of their own design. This will be documented in a report which will critically evaluate aspects of usability and following industry best practices.

- **OPTIONAL MODULE: Embedded Software Engineering (15 credits)**

Over the past 20 years the world of computing has moved on from large static desk top machines to small, mobile embedded devices. An embedded system is regarded as an application that contains at least one programmable computer (typically a MCU, ASIC, or DSP) where the user are in the main unaware that the system is computer based. This module will examine the key elements of embedded software development where engineers are faced with limited resources, hardware constraints while meeting performance, reliability and safety specifications. The module will provide an overview of peripherals, development methods, architectures, reliability issues and safety standards. Prior knowledge of a computing language e.g. C, C#, C++ is essential however work on FPGA's involving VHDL will be introduced at a beginner's level. The module will be assessed by a portfolio of coursework including a research paper, embedded system projects and an in class phase test.

- **OPTIONAL MODULE: Computer-Based Learning Environments (15 credits)**

Students will engage with aspects of key learning theories and the ways in which they may be applied to designing the structure and content of practical computer-based learning environments (CBLEs). The student will review and analyse a range of CBLEs and the tools and technologies which underpin them, in particular developments in Web 2.0 applications. The student will also be introduced to an analysis and development cycle suitable for the production of CBLEs 'fit for purpose' in a practical educational environment to enable them to produce a suitable artefact which will be a CBLE or their choice. The aspects of the module which are concerned with underpinning learning theory are assessed by means of a reflective 'blog' linked to personal experience as a learner, peer discussion and collaboration, and research. During in class lectures and seminars, students will collaborate and share ideas on a WIKI and on group forums, they will peer review each other's work and evidence that they have acted on feedback given, or justify why they took the decision not to. Following this, the student should be able to synthesise the results of analysis, and their newly-acquired knowledge of the possibilities of CBLEs, into an effective application of learning technologies. They will also be required to justify and evaluate the prototype CBLE which they have developed, with regard to their chosen specific learning situation. This module will help prepare the student to work in a variety of educational support roles, developing and maintaining CBLEs, and working alongside teaching specialists to achieve optimal results in the application of learning technology. The student may also use the experience of this module as a springboard for further educational study and a teaching / lecturing career or as a learning technologist.

- **OPTIONAL MODULE: Connecting the Network (15 credits)**

This module is based on the CCNA 4 element of the Cisco Routing & Switching curriculum. It builds on the Network Scaling Module by focusing on the Wide Area Network (WAN) technologies and network services required by converged applications in a complex network. In this module the student will learn about the selection criteria of network devices and WAN technologies to meet network requirements. The course will investigate different WAN technologies and their benefits as well as the operations and benefits of virtual private networks (VPNs) and tunnelling. The student will learn how to configure and troubleshoot both serial and broadband connections. This module will also explore IPsec tunnelling operations as well as monitoring and troubleshooting network operations using analytical tools such as syslog, SNMP, and NetFlow. At the end of the module the student will be able to configure and troubleshoot network devices and resolve common issues with data link protocols. Students will also develop the knowledge and skills needed to implement IPsec and Virtual Private Network (VPN) operations in a complex network. The module is delivered as a mixture of theory, delivered through a series of lectures, and practical implementation, delivered through a series of guided laboratory exercises. In the lab sessions students will gain deep understanding on the routing and switching concepts and acquire hands-on-skills using advanced network simulation tools that comply with industry standard router platforms. Students studying this module will be able to access on-line materials including the Cisco Networking Academy online curriculum, the VLE, and access a specialist laboratory.