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| 4100COMP  Semester 1  *Computing* | INTRODUCTION TO PROGRAMMING  (20c) | *Aim:*  To gain an understanding of how software is developed.  To become conversant with a range of computer programming paradigms.  To develop problem solving skills in computing.  To prepare students for software development at higher levels, both in work and study. | *Learning activities:*  Learning activities include lectures and tutorials where students are encouraged to ask questions / discuss scenarios and supported labs where students are encouraged to put theory gained though lectures and tutorials into practice. Directed reading against appropriate industry and research sources further reinforces learning. | *Assessment:*  Simple Application (40%) Complex Application (60%) |
| 4101COMP  Semester 1  *Computing* | COMPUTER SYSTEMS  (20c) | *Aim:*  To provide an understanding of the underlying computing platform (hardware, OS, network) upon which applications are developed and hosted | *Learning activities:*  Formal theory will be introduced via lectures and practical knowledge will be acquired via tutorials, laboratory exercises and coursework. | *Assessment:*  Digital System Design (50%) Examination (50%) |
| 4105COMP  Semester 1  *Computing* | INTRODUCTION TO COMPUTER FORENSICS AND SECURITY  (20c) | *Aim:*  To introduce the student to a range problem solving skills in computing and the associated tools and techniques used by practitioners in computer digital forensics and computer security. | *Learning activities:*  Lectures will typically include theoretical and practical components, which will prepare the student for the follow up practical and guided lab session. | *Assessment:*  Coursework 1 (50%) Coursework 2 (50%) |
| 4107COMP  Semester 1  *Computing* | PROGRAMMING FOR GAMES  (20c) | *Aim:*  To gain experience with the tools which form the ecosystem used to develop, compile, debug and test code using an appropriate high-level programming language.  To develop problem solving and programming skills to enable the student to design solutions to non-trivial problems and implement those solutions in a high-level language.  To relate software engineering and fundamental programming skills to computer games development.  To build a foundation for more advanced programming techniques, including object-oriented design and programming and the use of standard data structures and algorithms. | *Learning activities:*  Workshop – Tutor-led practical session in the computer laboratory to cover both theories and techniques of programming  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  In class test (40%) Design, Development and Test (60%) |
| 4108COMP  Semester 1  *Computing* | GAME DESIGN  (20c) | *Aim:*  To describe the core elements of computer game.  To explain the principles and methodologies of game design.  To describe and model the play mechanics for computer game.  To explain the psychological design considerations for computer game design.  To provide practical experience in computer and video games design. | *Learning activities:*  Lectures – to deliver the theoretical concepts on game design.  Workshop – Tutor-led practical session in the computer laboratory to introduce activities, techniques, methods and tools used in the process of design and prototyping both non-digital games and computer games.  Further exercises – additional exercises for students to practical work on in their own time.  Directed learning – provides additional reading to enable workshop work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Document and Prototype (80%) Game Design Reflection Report (20%) |
| 4110COMP  Semester 1  *Computing* | FUNDAMENTALS OF INFORMATION SYSTEMS  (20c) | *Aim:*  To introduce the concepts of information systems  To examine the various hardware and software components of information systems  To develop skills in designing and building information systems  To understand the planning and management of information systems  To explore the uses and impact of information systems. | *Learning activities:*  Theory will be covered via lectures and practical knowledge will be acquired via practical laboratory sessions and coursework. | *Assessment:*  Feasibility Study (50%) Group Coursework (50%) |
| 4112COMP  Semester 1  *Computing* | PRINCIPLES OF COMPUTER NETWORKS  (20c) | *Aim:*  To understand the principles and fundamental concepts that run through the study of computer networks  To understand the structure and components of typical computer networks, including routing and switching  To understand information system requirements regarding computer networking. | *Learning activities:*  Students will attend lectures, supported by tutorials and lab sessions to develop their theoretical and practical knowledge through tasks and discussions. | *Assessment:*  Network fundamentals (40%) Network design scenario (60%) |
| 4115COMP  Semester 1  *Computing* | DISCRETE MATHEMATICS  (20c) | *Aim:*  To enhance students problem solving skills through the use of mathematics and computer science techniques. | *Learning activities:*  Learning activities will be through lectures and practical sessions where students will be encouraged to ask questions and discuss case studies. The practical sessions will be based around supported labs where students will be encouraged to put the theory gained in lectures into practice. | *Assessment:*  Modelling exercise (40%) Examination (60%) |
| 4117COMP  Semester 1  *Computing* | FUNDAMENTALS OF DATA SCIENCE  (20c) | *Aim:*  To introduce the notions of data, information and knowledge discovery  To introduce the data science process and explore basic data science tools | *Learning activities:*  This module is intended to introduce the fundamental building blocks of data science. The theory introduced in lectures will be practised in laboratory sessions | *Assessment:*  Data Science Exercise (60%) Examination (40%) |
| 4119COMP  Semester 1  *Computing* | FUNDAMENTALS OF MULTIMEDIA  (20c) | *Aim:*  To provide an introduction to the theory and concepts of the various media components of multimedia development.  To link theory and practice by providing practical experience of developing multimedia artefacts using a variety of tools. | *Learning activities:*  Lectures will concentrate on the necessary theory underpinning these topics, while practical hands-on sessions will develop the capabilities to understand and use multimedia development tools appropriately. | *Assessment:*  Multimedia Artefacts (60%) Exam (40%) |
| 4120COMP  Semester 1  *Computing* | SOFTWARE ENGINEERING PRINCIPLES  (20c) | *Aim:*  To introduce the student to the basic processes involved in the development of a software project. To make the student aware of the type of systems encountered in software engineering and the software engineer’s role in systems development. | *Learning activities:*  This module will comprise of lectures and tutorial sesssions to provide practical examples of the materials discussed. | *Assessment:*  Portfolio (40%) Exam (60%) |
| 5101STATS  Semester 1  *Computing* | STATISTICAL MODELLING  (20c) | *Aim:*  To enable the students to understand and use simple and multiple linear regression models.  To enable the students to understand and use one-way and two-way Analysis of Variance models.  To give the students an overview of the statistical modelling process.  To extend the students' knowledge and understanding of linear statistical models.  To introduce the students to basic ideas of experimental design.  To give the students experience of using statistical models in practice. | *Learning activities:*  Lectures, tutorials and computing sessions. | *Assessment:*  Portfolio (40%) Examination (60%) |
| 5102COMP  Semester 1  *Computing* | DATABASE SYSTEMS  (20c) | *Aim:*  To implement relational database designs using modern database management systems.  To utilize database connectivity technologies in developing data driven applications.  To introduce database administration tasks and the key concepts of data management, quality and security.  To investigate database systems in the context of business intelligence. | *Learning activities:*  Learning activities include lectures and tutorials where students are encouraged to ask questions / discuss scenarios and supported labs where students are encouraged to put theory gained though lectures and tutorials into practice. Directed reading against appropriate industry and research sources further reinforces learning. | *Assessment:*  SQL Development (50%) Exam (50%) |
| 5103COMP  Semester 1  *Computing* | OPERATING SYSTEMS  (20c) | *Aim:*  To develop an understanding of different operating systems and their role within IT infrastructure.  To become familiar with these operating systems through practical excersises.  To gain an understanding of how command-line software is developed.  To gain knowledge of how operating system tools may be used for managing systems and networks.  To gain knowledge on managing and maintaining services offered by networked systems.  To appreciate a range of security measures involved in system administration. | *Learning activities:*  Lectures – to introduce the operating system and shell programming theories and techniques.  Tutorial sessions – discussion and tasks covering operating-system concepts.  Lab – practical tasks for students to solve using command-line tools and write their own scripts.  Directed reading – background reading to enable the lab work to be completed. | *Assessment:*  Essay (40%) Development tasks (60%) |
| 5106COMP  Semester 1  *Computing* | COMPUTER LAW  (20c) | *Aim:*  An overview of the English legal system and law making process  An understanding of the law relating to commercial transactions  An awarenes of the law relating to intellectual property and the provision of computer products and services  An understanding of the law relating to computer misuse resolution. | *Learning activities:*  Lectures-Tutorials, Directed Study Tasks. Students work as groups for their Coursework presentation but will study independent topics and the group process is only assessed formatively. | *Assessment:*  Advocacy group presentaions (40%) Exam (60%) |
| 5108COMP  Semester 1  *Computing* | 3D COMPUTER GRAPHICS  (20c) | *Aim:*  To provide mathematical knowledge essential in complex 3D graphics and animation.  To explain the key principles of 3D computer graphics.  To develop skills in 3D computer graphics operations using modern 3D graphical API.  To explain GPU graphics programming using shaders. | *Learning activities:*  Lectures – to deliver the theoretical concepts on maths applied to interactive 3D computer graphics.  Practical – Tutor-led practical session in the computer laboratory.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Shader & Procedural Animation (100%) |
| 5109COMP  Semester 1  *Computing* | DIGITAL GAMES CONTENT PRODUCTION  (20c) | *Aim:*  To explain the digital game content creation workflow.  To develop theoretical knowledge of the concepts and techniques required for 2D graphics, 3D modelling and 3D animation.  To provide students an opportunity to practice the principles of 3D modelling and 3D animation using appropriate tools, techniques and methods.  To explain the concepts and techiques for producing pre-rendered cinematics. | *Learning activities:*  Lectures – to deliver the theoretical concepts maths applied to production of game contents and assets.  Practical – Tutor-led practical session in the computer laboratory to introduce specific techniques and methods used in the production of textured 3D models to be incorporated into game engineand 3D animation sequences for off-line rendering.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  3D Modelling and Texturing (50%) Pre-rendered 3D Animation (50%) |
| 5110COMP  Semester 1  *Computing* | SOFTWARE ENGINEERING FOR GAMES  (20c) | *Aim:*  To develop the concepts of object oriented philosophy as applied to development for computer games.  To explain models, tools and techniques of development process for game software.  To explain formal principles of game software modelling.  To provide skills in using software APIs relevant for the computer games industry.  To provide students with knowledge, skills and experience in interactive application and games development. | *Learning activities:*  Lectures – to deliver the theoretical concepts on software engineering applied to games.  Practical – Tutor-led practical session in the computer laboratory.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Examination (40%) Object Oriented Game App (60%) |
| 5112COMP  Semester 1  *Computing* | PROJECT MANAGEMENT  (20c) | *Aim:*  To provide a fundamental understanding of the practical skills and underpinning theory required to manage successful IT projects. | *Learning activities:*  Lectures, tutorials and laboratory sessions. | *Assessment:*  Practical Report (50%) In-class Test (50%) |
| 5113COMP  Semester 1  *Computing* | INFORMATION SYSTEMS ANALYSIS AND DESIGN  (20c) | *Aim:*  To provide an understanding of the underlying principles of systems analysis and design. | *Learning activities:*  Formal theory will be introduced via lectures and practical knowledge will be acquired via tutorials and coursework. | *Assessment:*  System Analysis and Design (100%) |
| 5117COMP  Semester 1  *Computing* | DATA STRUCTURES AND ALGORITHMS  (20c) | *Aim:*  This is a practical, applied Software Engineering module with the aim of introducing the student to the fundamentals of Abstract Data Types and complexity of operations on ADTs followed by an implementation-based exploration of common data structures and operations, their implementations and applications | *Learning activities:*  Workshops, Directed Study Tasks | *Assessment:*  Implementation of software (40%) Examination (60%) |
| 5120COMP  Semester 1  *Computing* | ALGORITHM DESIGN  (20c) | *Aim:*  Gain an understanding of how to select and design data structures and algorithms to  solve computational problems.  Develop an understanding of key concepts of complexity theory and illustrate their relevance to practical problems of algorithm design.  Understand the difference between a tractable and intractable problem and apply the implications to practical situations. | *Learning activities:*  Lectures are supported by more informal seminars. | *Assessment:*  Assessing Algorithms (50%) Exam (50%) |
| 5121COMP  Semester 1  *Computing* | COMPILER DESIGN  (20c) | *Aim:*  To intoduce the concepts of languages and grammars leading to the principles of Compiler Design. | *Learning activities:*  Lectures will describe the main elements of theory, whilst laborartories and seminars will be used to examine the practical aspects of the module and illustrate the main concepts. | *Assessment:*  Code generation (40%) Exam (60%) |
| 5123COMP  Semester 1  *Computing* | STATISTICAL MODELLING  (20c) | *Aim:*  To develop a theoretical knowledge of statistical skills to solve data science problems  To develop and display solutions to data science problems by applying statistical theory using appropriate software applications | *Learning activities:*  Lectures will be used to introduce and demonstrate topics, however the key component in the module is the use of accessible practical tasks to reinforce the theoretical aspects of the lecture material which will be reinforced through practical work. | *Assessment:*  Case Study Analysis (60%) Examination (40%) |
| 5124COMP  Semester 1  *Computing* | DATA SCIENCE AND ANALYTICS  (20c) | *Aim:*  To contextualize the place of data science and the data analysis process in the organization  To introduce the hierarchy and uses of different analytical approaches | *Learning activities:*  Lectures will be used to introduce topics, which will be reinforced through practical work in practical sessions. Learning will largely be based on practical exercises and problem solving activities. | *Assessment:*  Data Analytic/Science Exercise (60%) Examination (40%) |
| 5127COMP  Semester 1  *Computing* | DIGITAL MEDIA PRODUCTION  (20c) | *Aim:*  To consolidate and extend previous knowledge and practical experience of digital  media production tools and techniques.  To provide experience and skills in devising, planning and managing the team  production of media rich experiences. | *Learning activities:*  Lectures will concentrate on the necessary theory of these topics while hands-on  practical sessions will develop the capabilities to design, create, produce and deliver  media rich experiences. | *Assessment:*  Individual Digital Media Portf (40%) Group Digital Media Project (60%) |
| 5129COMP  Semester 1  *Computing* | PROGRAMMING LANGUAGE THEORY  (20c) | *Aim:*  The module’s aim is to provide an introduction to the concepts behind programming languages, along with an explanation of the underpinnings of programmable machines. It will also discuss and demonstrate a variety of programming languages across both Imperative and Declarative paradigms | *Learning activities:*  Lab-Lectures, Directed Study Tasks | *Assessment:*  Basic language, interpreter (60%) Examination (40%) |
| 5131COMP  Semester 1  *Computing* | DATA STRUCTURES AND ALGORITHMS IN SECURITY  (20c) | *Aim:*  This is a practical, applied module with the aim of introducing the student to the fundamentals of Abstract Data Types and complexity of operations on ADTs, using a case study in relation to security problems. Emphasise the importance of ADT and algorithms in building software security solutions. Gain experience implementing common data structures and operations to solve security problems. | *Learning activities:*  Workshops and Directed Study Tasks | *Assessment:*  Design and implementation of s (40%) Examination (60%) |
| 5132COMP  Semester 1  *Computing* | NETWORK TECHNOLOGIES  (20c) | *Aim:*  To evaluate a range of principles, tools and techniques used for developing networking solutions  To assess the impact of networking issues such as congestion control, routing and virtualisation on networked applications and their algorithms | *Learning activities:*  Students will attend lectures, supported by tutorials and lab sessions to develop their theoretical and practical knowledge through tasks and discussions. | *Assessment:*  Network Design (100%) |
| 5133COMP  Semester 1  *Computing* | DATA STRUCTURES AND ALGORITHMS  (20c) | *Aim:*  This is a practical, applied Software Engineering module with the aim of introducing the student to the fundamentals of Abstract Data Types and complexity of operations on ADTs followed by an implementation-based exploration of common data structures and operations, their implementations and applications | *Learning activities:*  Workshops, Directed Study Tasks | *Assessment:*  Implementation of software (40%) Examination (60%) |
| 6101COMP  Semester 1  *Computing* | COMPUTER SECURITY  (20c) | *Aim:*  Understand security threats and vulnerabilities to information, computing and communications systems.  Assess critically a variety of generic security technologies for protection of computer networks.  Develop practical skills in the use of security countermeasure technologies and associated tools. | *Learning activities:*  Include attending lectures, practical sessions and tutorials, as well as reading online resouces. | *Assessment:*  Security Software Task (40%) Exam (60%) |
| 6104COMP  Semester 1  *Computing* | CLOUD AND MOBILE FORENSICS  (20c) | *Aim:*  To develop an advanced knowledge of mobile device forensics.  To gain experience of conducting forensic invesitgations on a range of mobile devices.  To understand the organisation and operation of Cloud Computing systems.  To critically assess the opportunities and restrictions of conducting cloud computing forensics. | *Learning activities:*  Students will participate in lectures, tutorials, and practical lab sessions. | *Assessment:*  Mobile Phone Investigation (50%) Exam (50%) |
| 6105COMP  Semester 1  *Computing* | GAMES ENGINE ARCHITECTURES  (20c) | *Aim:*  To compare and contrast architectural approaches to building a game engine architecture.  To gain an understanding of the importance of abstraction, decoupling and encapsulation within a game engine environment.  To understand how data structures and algorithms are formally applied to  To understand how the object oriented and data oriented paradigms are applied in an engine environment.  To understand how data-driven architectures can be used to abstract both content and behaviour in an engine environment.  To identify, formulate and apply solutions to a diverse range of advanced computer game problems across the architectural tiers.  To understand and use the structures and technologies of modern game engines.  To present advanced game programming techniques and technologies applicable to game development.  To implement key algorithms for optimising 3D scenes, organising game mechanics and structures.  To be able to integrate and use middleware libraries to solve domain-specific challenges in games (e.g. Physics, AI, Shaders, Maths, Procedural Generation). | *Learning activities:*  Workshop – to deliver the theoretical concepts on game engine architectures and tutor-led practical session in the computer laboratory.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable workshop work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Game Implementation (100%) |
| 6105STATS  Semester 1  *Computing* | STATISTICS IN THE WORKPLACE  (20c) | *Aim:*  This module aims to give students an experience of campus-based work related learning focusing on the role of a statistician in industry and how statistical methods are applied in both manufacturing and business. | *Learning activities:*  Lectures from staff and/or invited industrial statisticians, tutorials and laboratory sessions. | *Assessment:*  Portfolio (100%) |
| 6106COMP  Semester 1  *Computing* | MIXED REALITY TECHNOLOGIES  (20c) | *Aim:*  To describe the concepts and technologies for mixed reality.  To explain the principles and techniques of modelling and rendering virtual reality using appropriate tools and technology.  To provide opportunity for students to design, develop and evaluate mixed reality solution. | *Learning activities:*  Lectures – to deliver the concepts, methodologies and techniques on mixed reality technologies.  Workshop – Tutor-led workshop activities which will enable the students to practice the methods and techniques to design and protoype a mixed reality application.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable workshop work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Mixed Reality Application (50%) Examination (50%) |
| 6109COMP  Semester 1  *Computing* | BUSINESS SYSTEMS ANALYSIS  (20c) | *Aim:*  To integrate and extend previous learning and experience in systems investigation and development.  To develop competence in the investigation and design of complex or large scale business and IT systems.  To develop a broad repertoire of investigation techniques. | *Learning activities:*  Formal lectures introduce key concepts and practical sessions provide the opportunity to explore and assimilate those concepts. | *Assessment:*  Cybernetic Analysis (50%) Examination (50%) |
| 6110COMP  Semester 1  *Computing* | USER EXPERIENCE DESIGN  (20c) | *Aim:*  The aim of this module is to augment students' technical knowledge of systems development with an appreciation of the social-technical aspects of design. It covers the evolving area of User Experience (UX) design. This involves the students using UX methods to design and prototype an interactive system and then be able to validate their design against user requirements using UX evaluation techniques. | *Learning activities:*  Learning activities will be through lectures and practical tutorials where students will be encouraged to ask questions and discuss case studies. The practical tutorials will be based around supported labs where students will be encouraged to put the theory gained in lectures and tutorials into practice. | *Assessment:*  Predictive evaluation (40%) User participative evaluation (60%) |
| 6113COMP  Semester 1  *Computing* | NETWORK DEFENCE  (20c) | *Aim:*  To gain a significant understanding of various security vulnerabilities in and cyber threats to computer systems/applications as well as the importance of cyber security.  To assess critically a variety of intrusion detection and firewall techniques and tools for the protection of computer systems and applications.  Develop practical skills in the use of security countermeasure technologies and associated tools. | *Learning activities:*  Include attending lectures and tutorials, as well as reading online resources. | *Assessment:*  Network Security Scenario (40%) Exam (60%) |
| 6116COMP  Semester 1  *Computing* | INTERNET OF THINGS  (20c) | *Aim:*  To provide a comprehensive study in the Internet of Things including enabling technologies and various applications  To develop design skills for creating new IoT applications and implementation  To develop an understanding for requirements and technical solutions of intelligent services using sensing information | *Learning activities:*  Learning activities will be through lectures, practicals, and tutorials where students will be encouraged to ask questions and discuss case studies. | *Assessment:*  Design of IoT Application (50%) Exam (50%) |
| 6117COMP  Semester 1  *Computing* | ETHICAL HACKING  (20c) | *Aim:*  To gain a significant understanding of various security vulnerabilities in and cyber threats to computer systems/applications as well as the importance of cyber security.  To assess critically a variety of ethical hacking tools and techniques for the protection and evaluation of computer systems and applications.  To promote the use of appropriate security techniques to solve cyber security problems. | *Learning activities:*  Include attending lectures, practical sessions and tutorials, as well as reading online resources | *Assessment:*  Report on Hacking Tools (40%) Hacking and Defence Scenario (60%) |
| 6119COMP  Semester 1  *Computing* | COMPUTER SCIENCE APPLICATIONS  (20c) | *Aim:*  The aims of this module are to present the basic ideas of functional programming languages whilst demonstrating the main elements of good programming style; allowing the illustration of some uses and applications for functional programming | *Learning activities:*  The module will be supported by a series of short lectures based around the principles of functional programming as a computer science discipline. The major learning in the module is problem based with the students taking the short lecture series followed by practicals where their own research is used to produce a functional program that solves a given problem. | *Assessment:*  Problem Solution (90%) Working Software (10%) |
| 6122COMP  Semester 1  *Computing* | VIRTUALISED COMPUTING ARCHITECTURES  (20c) | *Aim:*  To provide the student with the ability to apply the methods and techniques involved in computing resource virtualisation, from individual machines to virtualised networked infrastructures | *Learning activities:*  Formal lectures will be supported by seminars and concept illustrations in more informal sessions. Practical aspects will be demonstrated and worked on in computing laboratories. | *Assessment:*  Virtualisation Implementation (40%) Exam (60%) |
| 6123COMP  Semester 1  *Computing* | ADVANCED AND DISTRIBUTED DATABASES  (20c) | *Aim:*  The aim of this module is build a recognition that traditional relational database approaches are incapable of dealing with “big data”. | *Learning activities:*  Lectures will introduce the underpinning theories of advanced and distributed database approaches, while practical sessions will implement those theories in a practical manner. | *Assessment:*  NoSQL Database Design Task (40%) NoSQL Development Task (60%) |
| 6124COMP  Semester 1  *Computing* | BIG DATA, TOOLS AND ANALYSIS  (20c) | *Aim:*  The aim of this module is to develop the knowledge and skills for working effectively with the large scale data storage and processing frameworks that underpin data science. | *Learning activities:*  Lectures will explore the underpinning theories of large scale data storage and processing approaches, while practical sessions will implement those theories in a practical manner. | *Assessment:*  Machine Learning Exercise (60%) Examination (40%) |
| 6127COMP  Semester 1  *Computing* | ADVANCED MULTIMEDIA  (20c) | *Aim:*  To develop a theoretical knowledge of the concepts of advanced media types and the advanced media production techniques and technologies required to design and develop digital media systems. | *Learning activities:*  Formal lectures will deliver theoretical concepts while practical-based workshop sessions, which take place in computer laboratories, will be used to introduce specific techniques and methods used in the development of advanced multimedia applications. | *Assessment:*  Coursework 1 (50%) Coursework 2 (50%) |
| 6129COMP  Semester 1  *Computing* | CONTEMPORARY SOFTWARE DEVELOPMENT  (20c) | *Aim:*  To use the latest methods and tools in software development to produce an industry standard piece of software | *Learning activities:*  This module will comprise of a small number of short lectures detailing modern trends in software development leading to problem based self-directed learning by the student There will be project development sessions involving regular team meetings with the tutor. Practical sessions where development techniques are demonstrated and acquired. Group work involving arranging and participating in software development team meetings. Presentations to their own group and students in other development teams. | *Assessment:*  Documentation for software (90%) Software Demo (10%) |
| 7101COMP  Semester 1  *Computing* | RESEARCH METHODS  (20c) | *Aim:*  To develop knowledge of effective and academic research design at masters level  and provide guidance on the purpose and design of literature reviews; the use of  theory; writing strategies; citation and ethical considerations.  To provide an understanding of how the range of qualitative, quantitative and mixed  method data approaches can be most appropriately applied  To provide help on establishing the most effectual research design and method for  the dissertation project and write a successful research proposal. | *Learning activities:*  Formal lectures will introduce core topics. Tutorials and in-class practical, Lab based activities will provide exercises to develop skills | *Assessment:*  Critical review (40%) Research proposal (60%) |
| 7129COMP  Semester 1  *Computing* | SOFTWARE DEVELOPMENT WITH JAVA  (20c) | *Aim:*  The course will develop the necessary skills for the development of object-oriented applications using the Java programming language. Students will work cooperatively in groups and demonstrate the skills required to engineer Java-based software applications from initial specification, through to implementation, testing and documentation. | *Learning activities:*  Lectures will be accompanied by practical lab-sessions. Students will be required to work in small groups to complete tasks, thereby encouraging communication and projects management skills. | *Assessment:*  OO Design and Implementation (50%) Software development (50%) |
| 7131COMP  Semester 1  *Computing* | COMPUTER SECURITY  (20c) | *Aim:*  To develop an understanding of Computer Security and to understand security threats and vulnerabilities to information, computing and communications systems.  To critically assess a variety of security technologies for protection of computer devices/systems/networks.  To promote the use of appropriate methodologies and tools in the analysis, design, implementation of secure systems.  To examine current research issues in Computer Security. | *Learning activities:*  Lectures, practical lab exercises, tutorials and advanced individual research. The individual research builds on core computer security concepts covered in the lectures through reading academic material, journals, and conference papers in the area of computer security. | *Assessment:*  Security Research Report (40%) Practical Security Solution (60%) |
| 7139COMP  Semester 1  *Computing* | INFORMATION SECURITY MANAGEMENT  (20c) | *Aim:*  To develop a deep appreciation of information security problems  To develop skills relating to security risk assessment and control analysis  To develop an appreciation of the complexity of using standards such as ISO-27001  To gain experience in engaging in debates around legal, ethical and professional issues relating to information security. | *Learning activities:*  Students will participate in lectures, tutorials/seminar sessions, including practicing risk assessment by using a software tool to produce a risk report. These sessions are to help students get a better understanding of the application of theory, in order to improve their learning before the exam. | *Assessment:*  Risk Assessment (40%) Examination (60%) |
| 7143COMP  Semester 1  *Computing* | Foundations of Machine Learning  (20c) | *Aim:*  To develop knowledge and an understanding of machine learning at masters level and provide guidance on the design and development of machine learning projects using both theory and practice.  To provide an understanding of a range of tools, techniques, algorithms, and data processing approaches.  To critically evaluate machine learning methodologies and their appropriate use to solve real-world problems. | *Learning activities:*  Formal lectures will introduce core topics. Tutorials and in-class practical, Lab based group activities will provide exercises to develop skills. | *Assessment:*  Theoretical Report (40%) ML Project (60%) |
| 7144COMP  Semester 1  *Computing* | Deep Learning Concepts and Techniques  (20c) | *Aim:*  To develop knowledge of effective and academic understanding of deep learning at masters level and provide guidance on the purpose, design and development of deep learning projects.  To provide an understanding of how the range of tools, techniques and  algorithms can be most appropriately applied.  To provide help on establishing best practice deep learning design and development principles to successfully complete a deep learning project. | *Learning activities:*  Formal lectures will introduce core topics. Tutorials and in-class group activities will provide exercises to develop skills | *Assessment:*  Report (40%) Prototype (60%) |
| 7148COMP  Semester 1  *Computing* | Software Engineering Concepts for AR/VR  (20c) | *Aim:*  (i) To compare and contrast architectural approaches to building AR/VR Applications.  (ii) To critically appraise the Software Architectures and Algorithmic Principles which underpin modern AR/VR Applications.  (iii) To practically apply the structures and technologies of AR/VR Middleware in tandem with a modern game engine.  (iv) To assimilate data and resources from Enterprise software into an AR/VR application for visualisation purposes.  (v) To understand the deployment of software solutions across a range of AR/VR related hardware.  (vi) To provide opportunity for students to design and develop mixed reality solutions. | *Learning activities:*  • Interactive Workshop – to deliver the concepts, methodologies and techniques relevant to developing AR/VR Software, alongside modern Game Engines.  • Workshop – Tutor-led workshop activities which will enable the students to practice the methods and techniques to design and prototype a mixed reality application.  • Further exercises – additional exercises for students to work on in their own time.  • Directed learning – provides additional reading to enable workshop work to be  completed.  • Learning materials can be accessed digitally via University Virtual Learning  • Environment (VLE). | *Assessment:*  Technical Analysis (40%) Application Enhancement (60%) |
| 7149COMP  Semester 1  *Computing* | Virtual Worlds for Shared Space Technologies  (20c) | *Aim:*  • To explain the digital content creation workflow for Virtual World construction  • To develop theoretical knowledge of the concepts and techniques required for 3D modelling and design of Virtual Worlds.  • To provide students an opportunity to practice the principles of 3D modelling Virtual World construction using appropriate tools, techniques and methods.  • To explain the fundamental mathematical principles of 3D computer graphics across the various stages of the programmable rendering pipeline.  • To compare and contrast algorithms used to model key aspects of photo realism in real-time.  • To outline the mathematical models used to represent visual phenomena such as light, colour, shadow, reflection in real-time and how they apply to material systems. | *Learning activities:*  Lectures – to deliver the theoretical concepts on maths applied to advanced 3D computer graphics.  Practical Workshop – Tutor-led practical session in the computer laboratory.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Virtual World Construction (60%) Exam (40%) |
| 4100STATS  Semester 2  *Computing* | DATA EXPLORATION AND ANALYSIS  (20c) | *Aim:*  To enable the student to carry out an exploratory analysis of a set of data either 'by hand' or using Minitab. This will include building knowledge of a simple relational databases in order to interrogate and filter data for analysis.  To provide the student with the required background knowledge of probability and random variables so that they can make use of a number of formal statistical models in their analyses.  To enable the student to appreciate the need for, and use of, confidence intervals in a number of commonly occurring data analysis situations.  To enable the student to appreciate the need for, and use of, hypothesis tests in a number of commonly occurring data analysis situations | *Learning activities:*  Lecture, tutorials, laboratory sessions, directed study | *Assessment:*  Data analysis - 2000 words (30%) Examination (70%) |
| 4102COMP  Semester 2  *Computing* | INTERNET AND WEB TECHNOLOGIES  (20c) | *Aim:*  To introduce students to the most common technologies underlying modern computer networking and communications, to introduce the basic concepts of internet and web technologies, to explore the design issues of modern networked applications. | *Learning activities:*  Learning activities will be through lectures and practical tutorials where students will be encouraged to ask questions and discuss case studies. The practical tutorials will be based around supported labs where students will be encouraged to put the theory gained in lectures and tutorials into practice. | *Assessment:*  Website development (50%) Exam (50%) |
| 4103COMP  Semester 2  *Computing* | PERSONAL AND PROFESSIONAL DEVELOPMENT  (20c) | *Aim:*  To introduce the notion of becoming a computing professional and working in the computing industry. To consider ethical frameworks and codes of conduct for the computing industry. To encourage personal development planning activities appropriate for career development. | *Learning activities:*  Lectures will be used to support theoretical knowledge. Small group seminars will be used to discuss the context of the lectures for each programme cohort. The World of Work Careers Centre staff will be closely involved in delivering content for and assessing the Self-Awareness statement. Personal Tutors will provide regular support to this module and work with students to help formulate their individual development plan. | *Assessment:*  Examination (80%) Self-awareness statement (20%) |
| 4104COMP  Semester 2  *Computing* | DATA MODELLING  (10c) | *Aim:*  To introduce the fundamentals of data manipulation and presentation.  To model and manipulate data using spreadsheet and database based applications.  To evaluate the advantages and disadvantages of spreadsheet and database based development models. | *Learning activities:*  Learning activities include lectures and tutorials where students are encouraged to ask questions / discuss scenarios and supported labs where students are encouraged to put theory gained though lectures and tutorials into practice. Directed reading against appropriate industry and research sources further reinforces learning. | *Assessment:*  Data Modelling Scenario (100%) |
| 4106COMP  Semester 2  *Computing* | PROBLEM SOLVING FOR COMPUTER FORENSICS  (20c) | *Aim:*  To familiarise students with scripting using a popular language.  To enhance students software development and problem solving skills  To develop employability skills including team/group work and communication | *Learning activities:*  Students will participate in lectures, practical tutorials / lab sessions and work in groups. | *Assessment:*  Group software project (80%) Group presentation (20%) |
| 4109COMP  Semester 2  *Computing* | MATHEMATICS AND 2D COMPUTER GRAPHICS  (20c) | *Aim:*  To provide mathematical principles in computer graphics.  To explain the underpinning concepts within computer graphics.  To teach 2D computer graphics operations using a modern graphical API.  To develop programming skills in computer graphics. | *Learning activities:*  Lectures – to deliver the theoretical concepts on mathematics applied to interactive 2D computer graphics.  Practical – Tutor-led practical session in the computer laboratory.  Workshop – Workshop session in the computer Laboratory.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Implementation of 2D graphic (50%) In class test (50%) |
| 4111COMP  Semester 2  *Computing* | PROBLEM SOLVING FOR INFORMATION SYSTEMS  (20c) | *Aim:*  To develop skills in computational thinking that can be used to develop programs to solve subject specific problems | *Learning activities:*  Learning will largely be based on practical exercises and problem solving activities. Lectures will be used to introduce topics, which will be reinforced through practical work. | *Assessment:*  Design Model (40%) Software Implementation (60%) |
| 4113COMP  Semester 2  *Computing* | NETWORK SOFTWARE DEVELOPMENT  (20c) | *Aim:*  To familiarise students with network protocol programming using a popular programming language.  To enhance students software development and problem solving skills  To develop employability skills including team/group work and communication | *Learning activities:*  Students will participate in lectures, practical tutorials / lab sessions and work in groups. | *Assessment:*  Design Model (40%) Software Implementation (60%) |
| 4114COMP  Semester 2  *Computing* | PROBLEM SOLVING FOR COMPUTER SECURITY  (20c) | *Aim:*  To enhance students programming skills using a popular programming language.  To enhance students software development and problem solving skills  To develop employability skills including team/group work and communication | *Learning activities:*  Students will participate in lectures, practical tutorials / lab sessions and work in groups. | *Assessment:*  Group software project (80%) Group presentation (20%) |
| 4116COMP  Semester 2  *Computing* | COMPUTER SCIENCE WORKSHOP  (20c) | *Aim:*  The module aims to introduce the students to problem solving using previously learnt programing skills. | *Learning activities:*  Activities will be based around a given problem topic. The sessions will be computing laboratory based, led by the students, with the support of tutorial staff. Students will form small software development teams to develop from specification through design to implementation and research, where necessary, a solution to the given problem. | *Assessment:*  Group work (100%) |
| 4118COMP  Semester 2  *Computing* | PROBLEM SOLVING FOR MULTIMEDIA COMPUTING  (20c) | *Aim:*  To develop skills in computational thinking that can be used to develop programs to solve subject specific problems | *Learning activities:*  Learning will largely be based on practical exercises and problem solving activities. Lectures will be used to introduce topics, which wil be reinforced through practical work. | *Assessment:*  Design Model (40%) Software Implementation (60%) |
| 4121COMP  Semester 2  *Computing* | SOFTWARE ENGINEERING WORKSHOP  (20c) | *Aim:*  The module aims to introduce the students to problem solving. Previously learnt programing skills will be brought to bear on problem scenarios, with the students designing and implementing computational solutions for problem solution. Additionally it is intended that the students work in small groups to solve the problem, introducing team working topics. | *Learning activities:*  Activities will be based around a given problem topic. The sessions will be computing laboratory based, led by the students, with the support of academic staff in the workshop. Students will form software development teams to develop from specification through design to implementation and research, where necessary, a solution to the given problem. | *Assessment:*  Group work (100%) |
| 4122COMP  Semester 2  *Computing* | INTRODUCTION TO INTERNET AND WEB DEVELOPMENT  (20c) | *Aim:*  To allow the student to investigate a variety of web development technologies and practice techniques for developing dynamic websites. | *Learning activities:*  A hands-on laborartory session where the student will develop their own dymamic web applications. | *Assessment:*  Web application (50%) Development Report (50%) |
| 4123COMP  Semester 2  *Computing* | PROBLEM SOLVING FOR DATA SCIENCE  (20c) | *Aim:*  To develop skills in computational thinking that can be used to develop programs to solve subject specific problems | *Learning activities:*  Learning will largely be based on practical exercises and problem solving activities. Lectures will be used to introduce topics, which will be reinforced through practical work. | *Assessment:*  Design Model (40%) Software Implementation & Test (60%) |
| 5100COMP  Semester 2  *Computing* | RESEARCH SKILLS  (10c) | *Aim:*  To prepare for undertaking a dissertation or research project  To understand research methods appropriate for computing disciplines  To develop a research proposal underpinning a dissertation or research project. | *Learning activities:*  Theory will be introduced via lectures and practical knowledge will be acquired via tutorials, laboratory exercises and coursework. | *Assessment:*  Project Proposal (100%) |
| 5101COMP  Semester 2  *Computing* | PROFESSIONAL ISSUES  (10c) | *Aim:*  To examine the legal, social, ethical and professional issues that are associated with working in the computing industry | *Learning activities:*  Lectures will provide theoretical knowledge of the syllabus. This will be supported by the Blackboard VLE where case studies and examples will be provided. Seminars will provide students the opportunity to formulate collective and individual approaches to solving problems. | *Assessment:*  Exam (100%) |
| 5103STATS  Semester 2  *Computing* | PROBABILITY AND RISK  (20c) | *Aim:*  To extend the student’s knowledge of, and experience in, the use of probability models.  To deepen the student’s understanding of important topics in inference.  To introduce the students to the use of simulation models.  To enable the student to familiarise themselves with risk techniques through which they can assist decision makers in making informed decisions in the face of uncertainty. | *Learning activities:*  Lectures, tutorials, laboratory sessions, directed reading, simulation. | *Assessment:*  coursework portfolio (50%) examination (50%) |
| 5104COMP  Semester 2  *Computing* | OBJECT ORIENTED SYSTEMS DEVELOPMENT  (20c) | *Aim:*  To investigate the underpinnings of object orientated design through the unified modelling language.  To implement an object oriented design with a modern language and application programming interface.  To utilize a modern integrated development environment in developing object oriented program code. | *Learning activities:*  Learning activities include lectures and tutorials where students are encouraged to ask questions / discuss scenarios and supported labs where students are encouraged to put theory gained though lectures and tutorials into practice. Directed reading against appropriate industry and research sources further reinforces learning. | *Assessment:*  UML Report (40%) OO Programming (60%) |
| 5105COMP  Semester 2  *Computing* | DIGITAL FORENSICS  (20c) | *Aim:*  To develop an understanding of the role of computer forensics analyst through the use of existing applications and investigative techniques. | *Learning activities:*  Lectures and practical work. The practical work builds on core forensic computing concepts covered in the lectures. This involves laboratory and user demonstrations of computer forensic techniques. | *Assessment:*  Forensic Investigation (50%) Exam (50%) |
| 5107COMP  Semester 2  *Computing* | DATA STRUCTURES AND ALGORITHMS FOR GAMES  (20c) | *Aim:*  To study abstract data types (ADTs) and common implementations of these data types.  To gain an understanding of how a game application utilises both Parallel and Sequental Algorithms.  To develop applications using the Boost/STL C++ containers in order to implement games applications.  To understand the application of the data-oriented design and Object-Oriented Design paradigms on Data Structures.  To build on programming skills through implementation of algorithms and use of appropriate data structures in problem solving for games development.  To recognise and specify how complexity of operations on these ADTs and their overall performance charactersics are affected by both the ADT in question and its implementation strategy | *Learning activities:*  Lectures – to deliver the theoretical concepts on data structures and algorithms applied to computer games development.  Practical – Tutor-led practical session in the computer laboratory.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Extending Game Using DSA (60%) Examination (40%) |
| 5111COMP  Semester 2  *Computing* | GAME PHYSICS AND AI  (20c) | *Aim:*  To explain the logical foundations and graph and tree-based approaches  representing decisions and paths in games.  To gain knowledge of mathematically modelling characters and the environment, using intelligent agent and multi-agent systems.  To explain and describe the role of mathematical principles such as numerical analysis and solvers underpinning physical simulation and dynamics.  To utilise game-industry standard middleware for the implementation of both domains. | *Learning activities:*  Lectures – to deliver the theoretical concepts on game physics and AI.  Practical – Tutor-led practical session in the computer laboratory.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Implementation of AI & Physics (50%) Examination (50%) |
| 5114COMP  Semester 2  *Computing* | ADVANCED WEB DEVELOPMENT  (20c) | *Aim:*  To present the concepts, methods and techniques used in the development and deployment of web applications and services.  To develop the concepts of multi-tier web application development, including: server-side programming, database connectivity and media rich client-side interface development.  To introduce wider concepts of web applications such as: legal issues, server hardware and system optimization | *Learning activities:*  Lectures will typically include theoretical and practical components, which will prepare the student for the follow up guided lab session. Practical components will cover: web application development, system configuration and the use of media rich content. | *Assessment:*  Individual Prototype (40%) Group-based Report (60%) |
| 5115COMP  Semester 2  *Computing* | DISTRIBUTED SYSTEMS  (20c) | *Aim:*  To assess a variety of principles, tools and techniques used for the design of distributed computer systems.  To evaluate the effect of distribution, benefits and problems, on the design and implementation of computer based solutions, and to design distributed systems using appropriate tools and techniques. | *Learning activities:*  Students will participate in lectures, tutorials, seminar/group work, and practical/lab  sessions. | *Assessment:*  Design of a distributed system (50%) Exam (50%) |
| 5116COMP  Semester 2  *Computing* | MOBILE COMPUTING  (20c) | *Aim:*  To develop an understanding of the theory and practice of building modern mobile computing system.  To introduce wireless communication and networking principles the support modern mobile computing systems  To provide an in-depth study of the application and network requirements of mobile computing systems. | *Learning activities:*  Students will participate in lectures, tutorials, and practical lab sessions. | *Assessment:*  Design of a mobile system (50%) Research on mobile technology (50%) |
| 5118COMP  Semester 2  *Computing* | SECURE SOFTWARE DEVELOPMENT  (20c) | *Aim:*  To familiarise students with common software security problems and vulnerabilities, and the methods, tools and techniques that can be used during software development to prevent them, including formal techniques.  To provide students with an understanding of techniques that should be applied throughout the software development lifecycle in order to improve software security. | *Learning activities:*  Students will participate in lectures, practical tutorials / lab sessions and work in groups. | *Assessment:*  Software development (80%) Presentation on security task (20%) |
| 5119COMP  Semester 2  *Computing* | INFORMATION ASSURANCE  (20c) | *Aim:*  To provide a detailed understanding of the main concepts of Information Assurance.  To develop an appreciation of the process of information security management, including risk analysis, control analysis and post-event security.  To develop an awareness of the standards relating to information assurance within enterprise environments, including legal and compliance issues. | *Learning activities:*  Students will participate in lectures, tutorials, and lab sessions. | *Assessment:*  Security Analysis (40%) Examination (60%) |
| 5122COMP  Semester 2  *Computing* | KNOWLEDGE-BASED SYSTEMS  (20c) | *Aim:*  To provide knowledge, understanding and experience on the development process, tools and techniques for producing knowledge –based and ‘intelligent’ systems. | *Learning activities:*  Lectures are aimed at providing students with fundamental concepts on knowledge-based systems, whereas seminars will cover practical aspects of the development of knowledge –based and intelligent systems. Lectures and seminars will prepare the students for the follow up guided lab session. Lab sessions will allow students to put knowledge gained in lectures and seminars into practice. | *Assessment:*  System Development (100%) |
| 5125COMP  Semester 2  *Computing* | DATA VISUALISATION  (20c) | *Aim:*  To develop critical awareness of the effective presentation of results/data  To develop the skills to produce effective data presentations to highlight the unique properties of specific data sets | *Learning activities:*  Lectures will introduce the underpinning theories of data visualisation, while practical sessions will implement those theories in a practical manner. | *Assessment:*  Data Visualisation (50%) Infographic Dashboard Developm (50%) |
| 5126COMP  Semester 2  *Computing* | DATA WAREHOUSING AND MINING  (20c) | *Aim:*  To investigate data warehousing in context of business intelligence.  To implement the principle models of data warehousing.  To utilize the process of extract, transform & loading in the construction of data warehousing.  To utilize data mining in the pursuit of effective knowledge discovery and decision making. | *Learning activities:*  Learning activities include lectures and tutorials where students are encouraged to ask questions / discuss scenarios and supported labs where students are encouraged to put theory gained though lectures and tutorials into practice. Directed reading against appropriate industry and research sources further reinforces learning. | *Assessment:*  Tabular Models (40%) Multi-Dimensional Models (60%) |
| 5128COMP  Semester 2  *Computing* | INTERACTIVE MULTIMEDIA SYSTEMS  (20c) | *Aim:*  To develop a theoretical knowledge of the concepts, media types and production techniques required to build interactive digital media systems and provide an opportunity to practice that theory.  To enable students to apply the principles of multimedia production and project management in digital multimedia communications projects showing an appreciation of the social, ethical and financial implications of these solutions | *Learning activities:*  Formal lectures will deliver theoretical concepts while practical-based workshop sessions, which take place in computer laboratories, will be used to introduce specific techniques and methods used in the development and creation of digital media content. | *Assessment:*  multimedia application dev (50%) Exam (50%) |
| 5130COMP  Semester 2  *Computing* | MOBILE AND WEB DEVELOPMENT  (20c) | *Aim:*  To provide knowledge of various mobile and web platforms and architectures and gain experience in designing and developing mobile and web applications. | *Learning activities:*  Learning activities will be through lectures and practical sessions where students will be encouraged to ask questions and discuss case studies. The practical sessions will be based around supported labs where students will be encouraged to put the theory gained in lectures into practice. | *Assessment:*  Web application (70%) Responsive web application (30%) |
| 6102COMP  Semester 2  *Computing* | NETWORK FORENSICS  (20c) | *Aim:*  To develop a critical appreciation of both the theoretical issues of computer networks and their impact on digital forensic investigations.  To explore the emergence of new networking technologies and how they will impact on network forensics.  To develop a practical understanding of network forensics as it applies to common applications or services.  To build the necessary skills, methodologies and processes to conduct a basic network forensics investigation within an organisation. | *Learning activities:*  Students will participate in lectures and practical lab sessions. | *Assessment:*  Network forensics research (50%) Analysis of Network Traffic (50%) |
| 6103COMP  Semester 2  *Computing* | FORENSIC INVESTIGATORY PRACTICE  (20c) | *Aim:*  To develop an understanding of the role of the expert witness in trials involving computer forensics.  Identify a range of appropriate methodologies and tools used during an investigation. Analysis of forensic images and preparation for presentation of results in a court of law. | *Learning activities:*  Lectures and practical work. The practical work builds on core forensic computing and English law concepts covered in the lectures. | *Assessment:*  Simulated crime (20%) Forensic Report (50%) Forensic Presentation (30%) |
| 6106STATS  Semester 2  *Computing* | MULTIVARIATE ANALYSIS AND DATA MINING  (20c) | *Aim:*  To enable the student to explore the structure of multidimensional data sets.  To introduce the student to inferential procedures using multivariate data.  To provide the student with familiarity with linear and flexible methods for regression and classification. | *Learning activities:*  Lectures cover the complete syllabus  Practicals are carried out alongside lectures for the purpose of consolidating the material through application of key methods to synthetic and real-world data sets. | *Assessment:*  Examination (60%) Coursework portfolio (40%) |
| 6107COMP  Semester 2  *Computing* | REAL-TIME RENDERING  (20c) | *Aim:*  To describe the architecture of graphics hardware and processing unit.  To explain the interaction between a graphics API, its shader and compute language and the GPU architecture.  To explain the principles of advanced computer graphics processes across the various stages of the programmable rendering pipeline.  To compare and contrast algorithms used to model key aspects of photo realism in real-time.  To outline the mathematical models used to represent visual phenomena such as light, colour, shadow, reflection in real-time.  To illustrate how post processing techniques can be used to simulate cinematographic effects in real-time.  To develop skills in advanced computer graphics operations using a modern graphical API and its shader/compute system. | *Learning activities:*  Lectures – to deliver the theoretical concepts on real-time rendering with demonstration.  Practical – Tutor-led practical session in the computer laboratory.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable practical work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Real-Time Rendering (60%) Examination (40%) |
| 6108COMP  Semester 2  *Computing* | GAME PRODUCTION  (20c) | *Aim:*  To describe the principles of the game production cycle and explain the issues relating to game production and approaches to managing game project.  To explain the principles and techniques of level design and provide opportunities for students to design and produce game environments with game-spaces.  To provide the underpinning knowledge, concepts and techniques of digital storytelling and cinematography for production of machinima and in-game cinematics.  To develop the required skills in using approriate approaches and technologies in producing machinima and in-game cinematics. | *Learning activities:*  Lectures – to deliver the concepts, methodologies and techniques on game production and level design.  Workshop – Tutor-led workshop activities which will enable the students to practice the methods and techniques to design and protoype a game level.  Further exercises – additional exercises for students to work on in their own time.  Directed learning – provides additional reading to enable workshop work to be completed.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Level Design and Cinematic (50%) Examination (50%) |
| 6111COMP  Semester 2  *Computing* | ADVANCED TOPICS IN INFORMATION SYSTEMS  (20c) | *Aim:*  To provide an understanding of the underlying technologies and concepts relating to advanced information systems. | *Learning activities:*  Formal theory will be introduced via lectures and practical knowledge will be acquired via tutorials, practicals and coursework. | *Assessment:*  Information System Design (100%) |
| 6112COMP  Semester 2  *Computing* | WEBSITE AND E-COMMERCE MANAGEMENT  (20c) | *Aim:*  This module extends students abilities beyond web development to website “management” by exploring the use of analytics to monitor user interactions with websites to both improve traffic to the site and increase the conversion of such visitors to customers. While techniques such as search engine optimisation, social media marketing and A/B testing etc. are primarily explored through e-commerce systems, the same techniques are equally applicable to the majority of web offerings. | *Learning activities:*  Lectures will concentrate on the necessary theory underpinning these topics, while practical hands-on sessions will develop the capabilities to understand and use multimedia development tools appropriately. | *Assessment:*  E-Commerce Website Development (100%) |
| 6114COMP  Semester 2  *Computing* | INFRASTRUCTURE AND SERVICES  (20c) | *Aim:*  To explore the network environment in modern large organisations and apreciate the complexity of the deployed infrastructure.  To understand the complex interactions between network services and the hollistic approach that must be adopted to strike a balance between utility and security. | *Learning activities:*  Students will participate in lectures, tutorials, and practical lab sessions. | *Assessment:*  Management of Large Networks (50%) Deployment of Network Services (50%) |
| 6118COMP  Semester 2  *Computing* | APPLIED CRYPTOGRAPHY  (20c) | *Aim:*  To develop an understanding of various security vulnerabilities in and threats to computer networks as well as the importance of network security.  To assess critically a variety of cryptographic algorithms and security techniques for protection of computer networks.  To promote the use of appropriate security techniques to solve network security problems. | *Learning activities:*  Include attending lectures and tutorials, as well as reading online resources. | *Assessment:*  Securing a network application (40%) Exam (60%) |
| 6120COMP  Semester 2  *Computing* | GRAPHICS AND DATA VISUALISATION  (20c) | *Aim:*  To use computer Graphic techniques to develop data and information visualisation: To introduce the theoretical concepts of graphical display, both 2D and 3D, leading to the practical development of visualisation solutions using relevant tools and techniques. | *Learning activities:*  Formal lectures will be complemented by hands-on practical laboratory sessions. | *Assessment:*  Visualisation Research (50%) Application (50%) |
| 6121COMP  Semester 2  *Computing* | PARALLEL ALGORITHMS  (20c) | *Aim:*  The aim of this module is to introduce the computational aspects of parallel and distributed computing and apply new techniques, methods and results from the rapidly-developing field of algorithms. | *Learning activities:*  Lectures are supported by seminars. | *Assessment:*  Algorithm Analysis (40%) Exam (60%) |
| 6126COMP  Semester 2  *Computing* | ADVANCED ANALYTICS  (20c) | *Aim:*  To consolidate and extend prior learning and experience of data science by exploring predictive analytics through the application of machine learning to data sets.  To build experience in the process of an analytical exercise. | *Learning activities:*  Lectures will introduce the underpinning theories of advanced analytics, while practical sessions will implement those theories in a practical manner. | *Assessment:*  Descriptive Modelling Task (50%) Predictive Modelling Task (50%) |
| 6128COMP  Semester 2  *Computing* | INNOVATIONS IN SOFTWARE DEVELOPMENT  (20c) | *Aim:*  To investigate the role and functionality of data warehouses in support of business intelligence.  To evaluate the process of extract, transform & loading in the construction of data warehouses.  To investigate the differing platforms available for business intelligence reporting.  To develop service oriented applications that support business intelligence dashboards. | *Learning activities:*  Learning activities include lectures and practical sessions where students are encouraged to ask questions / discuss scenarios and supported labs where students are encouraged to put theory gained though lectures and tutorials into practice. Directed reading against appropriate industry and research sources further reinforces learning. | *Assessment:*  Investigation concerning ETL (40%) BI Dashboard Dev (60%) |
| 6130COMP  Semester 2  *Computing* | CLOUD COMPUTING  (20c) | *Aim:*  To allow students to develop new advanced cloud-based software development skills and to combine their existing and new skills in a practical context. | *Learning activities:*  The module will provide both lecture and practical elements. Seminar work will build on existing knowledge of distributed systems, recapping and refocussing on its application to building large scale cloud applications. The practical element will involve hands-on cloud application development using real-world cloud services. Assessment will include a practical element that will also contribute as a learning activity. | *Assessment:*  Exam (50%) Report based on specification (50%) |
| 6131COMP  Semester 2  *Computing* | DISTRIBUTED AND EMBEDDED SYSTEMS  (20c) | *Aim:*  To provide an overview of designing and engineering both distributed software systems and embedded systems with references to architectures, communication and synchronisation. The practical focus of this module is on developing software with concurrent and distributed components and developing for embedded systems. | *Learning activities:*  Students will participate in workshop/lab sessions with taught elements. | *Assessment:*  Distributed software (50%) Examination (50%) |
| 6133COMP  Semester 2  *Computing* | Advanced Topics in Networking  (20c) | *Aim:*  To develop and extend students ability to critically analyse state-of-the-art developments in networking. | *Learning activities:*  Students will attend lectures, supported by tutorials and lab sessions to develop their theoretical and practical knowledge through tasks and discussions. | *Assessment:*  Application Evaluation (50%) Network Design Model (50%) |
| 7107COMP  Semester 2  *Computing* | COMPUTER SYSTEMS TECHNOLOGY  (20c) | *Aim:*  To evaluate the effect of distribution, benefits and problems, on the design and implementation of computer based solutions, using performance analysis tools. To assess critically a variety of principles, tools and techniques used for the design of distributed computer systems. | *Learning activities:*  Lectures, tutorials, directed reading of books, advanced journals, conference papers and other publications. | *Assessment:*  Distributed systems design (40%) Examination (60%) |
| 7120COMP  Semester 2  *Computing* | MANAGEMENT OF E-BUSINESS  (20c) | *Aim:*  This module develops analytical and research skills in the area of the management of e-commerce, including the technological, business and legal aspects of such. Overall lectures in this module will provide the students with in-depth analyses of various concepts concerned with co-ordinating technological and business strategies  in the process of electronically buying and selling goods, services and information that impacts individuals and businesses. | *Learning activities:*  Lectures will cover the issues mentioned in the aims and objectives above. In addition to the lectures, learning activities will be facilitated through various assignments (both individual and group), class discussion and case studies. | *Assessment:*  Research Paper (50%) E-Business Prototype (50%) |
| 7127COMP  Semester 2  *Computing* | DATABASE DESIGN AND TECHNOLOGY  (20c) | *Aim:*  To examine critically selected techniques for modelling the data requirements of database applications at the conceptual level.  To develop and understand contemporary advanced issues of database design, with specific interest in the context of business intelligence.  For example how core concepts in databases may be applied and developed to solve research problems such as handling Big Data and Temporal Data.  To develop an informed appreciation of significant, current issues and trends in database systems. | *Learning activities:*  Formal lectures will introduce core topics.  Tutorials and in-class group activities will provide exercises to develop skills.  Practical exercises using relational and object related databases. | *Assessment:*  Design and evaluation (50%) Survey paper (50%) |
| 7133COMP  Semester 2  *Computing* | NETWORK SECURITY  (20c) | *Aim:*  To develop an understanding of various security vulnerabilities in and threats to computer networks as well as the importance of network security.  To assess critically a variety of generic security technologies for protection of computer networks.  To promote the use of appropriate security techniques to solve network security problems. | *Learning activities:*  Include attending lectures and tutorials, as well as reading books and handouts. | *Assessment:*  Design and analysis (40%) Examination (60%) |
| 7141COMP  Semester 2  *Computing* | ETHICAL HACKING  (20c) | *Aim:*  To gain a significant understanding of various security vulnerabilities and cyber threats to computer systems/applications as well as the importance of cyber security.  To assess critically a variety of ethical hacking tools and penetration testing techniques for the protection and evaluation of computer systems and applications.  To promote the use of appropriate ethical security techniques to solve cyber security problems.  To understand practices of network forensics and intrusion analysis to aid cyber threat intelligence gathering.  To develop independent research skills in threat intelligence to detect, respond to, and defeat focused and targeted threats. | *Learning activities:*  Include attending lectures, practical sessions and tutorials, as well as reading online resources. | *Assessment:*  Report on hacking tools (40%) Report on defence tools (60%) |
| 7142COMP  Semester 2  *Computing* | SECURE SYSTEMS  (20c) | *Aim:*  To familiarise students with common system security techniques, tools and methods that can be utilised during the design, deployment and maintenance of systems.  To allow students to develop new advanced security skills and to combine their existing and new skills in a practical context. | *Learning activities:*  Students will participate in lectures and practical lab sessions to obtain both theoretical and practical knowledge. The theoretical aspects of the module will largely build on existing knowledge, but recapping and refocussing on its application to real-world systems. The practical aspects will involve hands-on system configuration, automation and familiarisation with industry tools. The assessment will also include a practical element that will also contribute as a learning activity. | *Assessment:*  Secure system report (40%) Secure system implementation (60%) |
| 7145COMP  Semester 2  *Computing* | Accelerated Machine Learning  (20c) | *Aim:*  To develop knowledge of accelerated machine learning at masters level and provide guidance on the purpose, design and development of accelerated machine learning projects.  To provide an understanding of how the range of tools, techniques and algorithms can be applied for accelerated machine learning.  To provide help on establishing accelerated machine learning design and development principles to successfully complete large scale machine learning projects. | *Learning activities:*  Formal lectures will introduce core topics. Tutorials and in-class group activities will provide exercises to develop skills | *Assessment:*  Report (40%) Prototype (60%) |
| 7146COMP  Semester 2  *Computing* | Advanced Topics in Deep Learning  (20c) | *Aim:*  To develop knowledge of advanced topics in deep learning at masters level and provide guidance on the purpose, design and development of deep learning projects using advanced constructs.  To provide an understanding of the range of tools, techniques and algorithms used in advanced deep learning architectures.  To provide help on establishing advanced deep learning design and development principles to successfully complete a deep learning project. | *Learning activities:*  Formal lectures will introduce core topics. Tutorials and in-class practical group activities will provide exercises to develop skills. | *Assessment:*  Report (40%) Prototype (60%) |
| 7147COMP  Semester 2  *Computing* | Enterprise Machine Learning  (20c) | *Aim:*  To develop knowledge of enterprise machine learning at master’s degree level and provide guidance on the design decisions required for large scale deployment.  To provide an understanding of enterprise tools and how they can be used to deploy machine learning projects.  To provide help on establishing deployment strategies for large scale machine learning projects. | *Learning activities:*  Formal lectures will introduce core topics. Tutorials and in-class practical group activities will provide exercises to develop skills | *Assessment:*  Report (40%) Prototype (60%) |
| 7150COMP  Semester 2  *Computing* | User Experience Design for Immersive Technology  (20c) | *Aim:*  Develop knowledge of:  (i) design practices for immersive environments utilising virtual and augmented reality technology  (ii) skills in defining usability metrics to be used in the design process of immersive technology  (iii) the techniques applied to the critical evaluation of immersive technology  (iv) carrying out experiments examining the usability of immersive products | *Learning activities:*  Lectures, Tutorials, practical group work in labs and self-directed learning in analytical and modelling skills, problem-based learning workshops in design, prototyping and evaluation.  Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Design and Analysis (50%) Implementation and Testing (50%) |
| 7151COMP  Semester 2  *Computing* | Advanced Topics in Augmented Reality  (20c) | *Aim:*  (i) To develop advanced theoretical and practical research skills in Augmented Reality.  (ii) To develop a critical appreciation of the theoretical and practical issues related to Augmented Reality.  (iii) To understand the Hardware Limitations of Mobile Vision Systems in supporting the Digital Augmentation of a real-world scene.  (iv) To develop a student’s appreciation of a variety of approaches to constructing a Digital Representation of a real-world scene captured via an AR device.  (v) To enable students to use state-of-the-art technologies and hardware in the development of Augmented Reality applications.  (vi) To practically apply state-of-the-art development techniques in order to Augment a real-world scene with knowledge and interactions. | *Learning activities:*  • Lectures – to deliver the concepts, methodologies and techniques relevant to specific domains and algorithms in the fields of Data Visualisation and Virtual Reality.  • Workshop – Tutor-led workshop activities which will enable the students to practice the methods and techniques to design and prototype a Virtual Reality Application.  • Further exercises – additional exercises for students to work on in their own time.  • Directed learning – provides additional reading to enable workshop work to be  completed.  • Learning materials can be accessed digitally via University Virtual Learning Environment (VLE). | *Assessment:*  Augmenting a Real World Scene (60%) Examination (40%) |
| 7152COMP  Semester 2  *Computing* | Advanced Topics in Virtual Reality  (20c) | *Aim:*  (i) To develop advanced theoretical and practical research skills in Virtual Reality  (ii) To develop a critical appreciation of the theoretical and practical issues related to Virtual Reality.  (iii) To understand the Human Physiological and Neuro Perception issues that affect how Virtual Reality is perceived by users.  (iv) To develop student’s appreciation of a variety of approaches to visualise data in a Virtual Reality context.  (v) To provide knowledge of the characteristics of data that lend themselves to a Virtual Reality based representation.  (vi) To enable students to use state-of the art technologies and hardware in the development of Virtual Reality applications.  (vii) To practically apply state of the art development techniques in order to synthesise a VR solution. | *Learning activities:*  • Interactive Workshop Lectures – to deliver the concepts, methodologies and techniques relevant to specific domains and algorithms in the fields of Data Visualisation and Virtual Reality.  • Workshop – Tutor-led workshop activities which will enable the students to practice the methods and techniques to design and prototype a Virtual Reality Application.  • Further exercises – additional exercises for students to work on in their own time.  • Directed learning – provides additional reading to enable workshop work to be  completed.  • Learning materials can be accessed digitally via University Virtual Learning  • Environment (VLE). | *Assessment:*  Prototype (80%) Presentation (20%) |
| 6100COMP  Yearlong  *Computing* | PROJECT  (40c) | *Aim:*  To enable the student to use rigorous development or scientific methods to produce an artefact relevant to their programme of study.  To present results both orally and as a written report. | *Learning activities:*  Research methods, project planning and project management methods are introduced in lectures. Students are allocated a supervisor who advises them throughout the year and checks on their progress. | *Assessment:*  Project Report (90%) Presentation (10%) |