STAFFORDSHIRE UNIVERSITY

Faculty of Computing Engineering and Technology
AWARD HANDBOOK 2009-10

Computer
Games Programming
& Graphics

DipHE, BSc, BSc(Hons), BEng, BEng(Hons), MEng **Computer Games Programming**
DipHE, BSc, BSc(Hons), BEng, BEng(Hons), MEng **Computer Graphics***
DipHE, BSc, BSc(Hons), BEng, BEng(Hons), MEng **Computer Games Artificial Intelligence**
DipHE, BSc, BSc(Hons), BEng, BEng(Hons), MEng **Portable Computer Games Programming**
DipHE, BSc, BSc(Hons), BEng, BEng(Hons), MEng **Multiplayer Online Games Programming**
DipHE, BSc, BSc(Hons), BEng, BEng(Hons), MEng **Arcade Game and Simulator Development**

Award handbook: Computer Games Programming and Graphics Scheme
May 2008

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PART 1
Your award

Section 1: Introduction

The purpose of this Award Handbook is to provide you with information concerning the rationale and contents of the Computer Games Programming and Computer Graphics awards. It attempts to answer many of the questions you may ask throughout your study at Staffordshire University. Some of the people you may wish to contact are:-

Award Management

CGPG Scheme Leader – in charge of Computer Games Programming and Graphics Awards
Bob Hobbs; room: K325; phone: (01785) 353465; e-mail: r.g.hobbs@staffs.ac.uk

Placement Tutor – in overall charge of placements.
Ian Sunley; room: K218; phone: (01785) 353418; e-mail: G.I.Sunley@staffs.ac.uk

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Rob Kinmond; room: K336; phone: (01785) 353305; e-mail: R.M.Kinmond@staffs.ac.uk

Administrative and Pastoral Support

CGPG Administrator – administrative support for CSSE awards
Julie Perkins; room: K243; phone: (01785) 353432; e-mail: J.A.Perkins@staffs.ac.uk

Placements Manager – day to day management of the Placements Unit.
Maria-Louise Feenan; room: K216; phone: (01785) 353257; e-mail: M.Feenan@staffs.ac.uk

Student Advisor – general pastoral support and guidance.
Janice Kalisz; room: K232; phone: (01785) 353345; e-mail: J.C.Kalisz@staffs.ac.uk

A full list of staff contact information may be found for all staff at
http://www. staffs.ac.uk/ fcet. htm

The Internet

A range of information is held on MyPortal and on the internet at the following address:

http://www.staffs.ac.uk/fcet.

You can find up to date details of timetables, assessment deadlines, tutors, modules and the Computer Games programming Student Handbook. Many staff place lecture slides and support material on their personal intranet web pages. These can be found via the Staff home pages.

Additionally you can find

- Information about the library may be found at http://library.staffs.ac.uk/#focus

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- Information about Information Services may be found at
http://www.staffs.ac.uk/uniservices/infoservices/

- Information about the facilities available in the various computing laboratories may be found at http://www.fcet.staffs.ac.uk/current_students/labs.htm

However, each module you are enrolled on module should also be on the **Blackboard** Virtual Learning Environment:

http://blackboard.staffs.ac.uk

Section 2: Glossary of terms

Module	A unit of study with a defined learning outcomes, curriculum and assessment. The module definition is to be found in the module specification for the module. Each module has a number of CATS points (Credit Accumulation and Transfer Award points), associated with it. CATS points are often known by the simpler name of credits. A single module is worth 15 Credits and notionally requires 150 hours of learning activity to complete. This learning activity being divided between time for class contact hours with staff, independent study and assessment. The number of allocated learning hours rises in proportion to the number of Credits attributed to a module at the rate of 10 hour per credit. All modules are multiples of the basic unit of 15 Credits. So for example, a double module will be worth 30 Credits and will have a learning time of 300 hours. Further details are given in the Undergraduate Modular Framework Regulations.
Core module	This is a module that you must take and pass to qualify for a given award title or range of titles.
Computing option	A Computing Option is a module which is specifically for students taking the Computer Games programming award. These modules can be found at the back of this handbook.
General option	This is a module which you can choose from a set of modules which have been designed to complement your Award. This is to allow you to broaden your knowledge and skills base if you wish by taking some supplementary studies in addition to your main subject area. More specifically for students on the Computer Games programming award, a general option slot is where modules can be chosen from the modules on the University General Option list, **excepting modules from the University IT Programme** – again provided the module has not already been taken and any module specific admission requirements are met. See http://www.staffs.ac.uk/modules/options/index.php If the module you choose is from a) above then the module will count as a specific option module (specifically a computing option module). If the module you choose is from b) above, then it will count as a general option module. The available modules may be subject to constraints such as timetabling, disqualified combinations and pre-requisites.
Level	This indicates the academic level at which study is to be undertaken – Certificate level (module level 1), Intermediate level (module level 2) and Honours level (module level 3). Normally it corresponds to one year of study for full-time students. However, students may take modules from different levels at the same time, provided that they meet the requirements for their award.
Curriculum	The subject content of your studies. This can be used to refer to a single module or to the content of a package of modules.

Co-requisites	Co-requisites are those modules that you must take as a package. All the Level C core modules can be considered to be co-requisites. We have defined co-requisites to make sure that there is sufficient shape and coherence in your programme of study to make it a rewarding and interesting experience. A co-requisite is therefore a module which must be studied in addition to and normally at the same time as a particular module.
Disqualified Combinations	Although rare on the Computer Games programming award, disqualified combinations are those modules which you cannot study together. This is normally because the content of the modules overlaps in some way, such that by taking both you would not cover the equivalent of two-modules learning.
Grade (Point)	On completion of the assessment of a module, you will be assigned a grade for that module in the range 0 to 15. In considering your performance at the end of a Level, grades will be averaged to produce grade point average for the Level. The Level H project counts as 3 separate grades. For further details, please refer to the Undergraduate Modular Framework Regulations.
Learning Time	The total time needed to complete the classes, private study and assessments for a module.
Pre-requisites	A pre-requisite is defined as a specific requirement that you must meet before you can take a module. In a similar way as entry to an Award was dependent on your achieving A-Level or BTEC passes for example, or having other prior knowledge, for some modules you will have to be 'qualified' to take them. This will normally mean studying for a module at an earlier level in the award.

Pre-requisites are specified to make sure that you have the knowledge and skills you will need to be successful in your chosen modules. Please refer to the Undergraduate Modular Framework Regulations for a more detailed description of this term in particular the distinction between the terms 'Pre-requisites' and 'Special Admissions Requirements'. |
| **Special Admissions Requirements** | The information given here provides you with the details as to the type of background knowledge you will be expected to have accumulated prior to the start of a module. This knowledge may have been acquired by studies which you have undertaken before entering the University. Further details are given in the Undergraduate Modular Framework Regulations handbook, in particular the distinction between the terms 'Special Admissions Requirements' and 'Pre-requisites'. |
| **Teaching block** | A period of study into which the year is divided, that may include induction, learning, assessment and academic counselling. There are currently two teaching blocks in each academic year. |

Section 3: Educational aims and overview of the scheme

Guiding philosophy

The focus of this programme is to develop people with the high level of computing skill necessary to solve complex problems and imaginatively transform designs and concepts into a wide range of graphical-based applications. Its basis is a broad grounding in computing skills, provided by the course, which also enable pursuit of a more traditional computing career if desired. Graduates will be competent in a clear set of industry-relevant techniques and skills as well as having a good understanding of the role and scope that these skills have in their application. Problem-solving, critical evaluation and reflection are integral parts of the programme and will enable graduates to transfer their skills and learned theory to the extent that they will be able to contribute to the cutting-edge of software development in the graphics and games industry and to relevant research programmes.

Educational aims of the programme

The guiding philosophy is realised by a programme of study with the following educational aims.

1. Provide a sound general education in computer games programming and computer graphics
2. Enable the student to achieve the highest award within his or her overall ability.
3. Enable the student to specialise in depth in areas corresponding to his or her ability and choice.
4. Whenever possible, give a practical emphasis to the student's studies.
5. Provide a programme in which the student's general education is enhanced, including transferable skills
6. [Sandwich awards only]Enable the student, by means of a one-year period of supervised work in an industrial, commercial or public service setting, to gain relevant experience in the computing profession, and as far as possible gainfully to exploit that experience during the student's final year.
7. Produce graduates who are fitted to undertake employment in industry, commerce or public service as computing professionals, or (for those with suitable degree classification) to undertake programmes of further study or research in appropriate institutions.
8. Ensure that the student has as wide a range of choice and flexibility as possible, whilst ensuring that individual awards are coherent and meaningful.
9. [MEng only]Provide a programme in which students can develop an ability to develop solutions to problems taking into account commercial factors such as cost, reliability, marketability and other quality criteria.

Specifically for each award:

Computer Games Programming

The award opens up opportunities with computer games companies. It also enables graduates set up their own games company or do contract work within the industry. The focus of this award is on developing people with the computing skills necessary to transform a game design into a running program that delivers the game to the game player on a hardware platform. As such it is a vital career role in the computer games industry. Graduates will understand the concepts and practices involved in computer games production such as design of game levels and concepts, practical strategies for game

development and underpinning skills such as programming, artificial intelligence, system analysis and design and other aspects of applied science.

Computer Graphics

This award prepares students for a career in the application of software engineering to visual systems such as the development and maintenance of user interfaces, animation, games, virtual reality, image processing and fractals. Graduates will be competent in the creation and maintenance of graphical interfaces, image processing and computer vision systems and the representation and use of dynamic systems and large data sets using computer graphics programming techniques. Graduates will know how to design and implement graphical interfaces to meet user needs; implement and apply algorithms for the visualisation of multi-dimensional and sparse data sets; solve industrial and commercial imaging problems effectively and efficiently using computer technology and design and implement graphical systems. The graduate from this award will understand and use mathematical concepts and principles to a greater extent than the majority of the computing-oriented awards.

Games AI

The award is intended to achieve two aims. Firstly to meet a need anticipated in the computer games industry for specialists in AI programming. Now that many of the graphical rendering is managed by separate hardware, processor cycles have been freed up for use in the provision of Artificial Intelligence in games to improve the "playability". Secondly the course is intended to provide an award which focuses on practical aspects of AI, which have applicability beyond the sphere of computer games. Along with the other awards within the scheme, the aim is to produce graduates capable of integrating into existing games companies, and to form their own enterprises. Graduates will understand the concepts and practices involved in computer games production with particular emphasis on AI, practical techniques and strategies for game development and underpinning skills such as programming, system analysis and design and other aspects of applied science.

Portable Games Programming

Portable games are played on handheld games consoles such as the PlayStation Portable and Nintendo DS, and on more general purpose devices such as mobile phones and PDAs. This sector of the games industry is rapidly growing and involves different challenges than traditional PC and console game devices: display screens are smaller and use fewer colours, user input might be via a keypad or touch screen rather than a keyboard, and device memory and storage space is restricted. There is a wide variety of portable hardware and software platforms to cater for, and the capabilities of mobile networks and services to exploit. The games themselves tend to be simpler and shorter than traditional computer games, allowing users to play them on the move and tolerate interruptions. This means development times tend to be shorter and teams smaller than for traditional computer games.

This award prepares students to develop games for the next generation of handheld and mobile devices. Students on this award will learn techniques such as general and graphics programming, artificial intelligence, games physics, system analysis and design and games production common to all the games awards. They will learn to apply these concepts in the constrained environments of portable systems, and will be exposed to a range of portable devices and development environments. Graduates will be equipped for employment in games studios specialising developing games for mobile or handheld systems, for contract work or setting up their own portable games company, for general mobile application or computer games development, and for employment in the wider Computing industry.

Multiplayer Online Game Programming

The aim of this award is to support the student in the development of the technical skills and understanding of the online game market including fantasy worlds and collaborative games such as *World of Warcraft, Counterstrike* and *Second Life*. Potential students will be enthused and committed to this type of development which features server-hosted game and virtual worlds theory together with programming concepts showing recognition of the main theme to the award as a potential academic subject.

The delivery is intended to be programming-centric and will look at the integration of graphics, online games, networking, internet technology and software engineering principles such as design patterns and three-tier architecture.

The integration of networking principles and collaborative games/virtual environments is an attractive and exciting proposition and will prepare for progression to more advanced research-oriented topics such as 'serious games', the use of games to support serious study, and social networking. Additional qualifications will be available through Cisco Accreditation.

Arcade Game and Simulator Development

This award is designed to encompass the range of interactive games which have a high level of dependency on a typical peripheral data acquisition and feedback. Such devices as joysticks and wheels would be in this category but could also include such game specific constructs as dance mats, platforms and rigs to be designed for a specific game or simulator. The main areas of study will be the programming of 3D graphics, the understanding and programming of dedicated device drivers for peripheral devices, the principles and programming techniques used in simulation, the underpinning understanding of motion, dynamics and kinematics used in simulators, the understanding of visual and other semantic cues used in the generic types of game and simulator in popular usage.

The aim of this award is to extend academically into principles of simulation which are used in many areas of implementation and provide scope for advanced research and development at post-graduate level. Understanding the nature of platforms such as the Nintendo Wii will focus learning toward more interactive game playing and the devices which support them.

Section 4: Learning outcomes

All awards in the scheme are managed in Levels. These are:- Level C (first year), Level I (second year) and Level H (third year). There is also a placement year Level P which usually occurs between year 2 and 3

Progression through to the final year Level H will, after successful completion of the modules, result in the award of **Batchelor of Science (BSc)** or **Batchelor of Engineering (BEng)** with honours. The honours will be classified between third class honours and First class honours (see section 4 Part 2 for award classification details).

Intermediate awards of **Certificate of Higher Education and Diploma in Higher Education** are available to you if you do not wish to proceed beyond levels C (Certificate) and I (Intermediate) respectively, provided you meet the qualification requirements.

An **ordinary degree** is offered. This is to enable you, if you have difficulty in completing the Honours degree due to academic or other problems, to transfer onto a degree that will make it easier to complete an award successfully. However, if you successfully complete the

ordinary degree, you may at a later date apply to return as a direct entrant onto level H of the Computer Games programming award to complete an Honours degree. The ordinary degree is unclassified and does not require a placement.

You may enrol onto a **sandwich or non-sandwich** version of the award. However, we strongly encourage you to enrol onto a sandwich version. This is because the Faculty believes that students gain great benefit from the completion of an industrial placement and wish to reflect that belief by a giving students a strong recommendation to pursue a sandwich version. Transfer between sandwich and non-sandwich versions of the award is covered in detail in Section 21 on Admissions and Transfer Criteria. The main principles are that transfer from a non-sandwich version to a sandwich version is relatively unrestricted (but see Section 21), transfer from a sandwich to a non-sandwich version is only unrestricted during level C, after which it becomes subject to the student meeting various qualifying criteria (these criteria are set out in detail in Section 21).

Each level has learning outcomes specified for each level to demonstrate progression through the award and to define the specific outcomes that a student will be able to demonstrate on exit from the scheme at any of the contributory levels.

The Computer Games programming award provides you with opportunities to develop and demonstrate knowledge, understanding, cognitive and practical skills, within the discipline of computer games programming and graphics. Learning outcomes identify the nature of the abilities and skills you are expected to achieve, by the time you graduate.

The University has adopted a framework for specifying learning outcomes. Eight categories of learning outcomes have been identified and exemplar indicative descriptions of learning outcomes within each category appropriate to the given level of study have been produced as guidance. These categories and the exemplar indicative descriptions of learning outcomes map directly onto the requirements of the National Qualifications Framework. This is to ensure that any award the produces learning outcomes that can be mapped onto the eight categories and are consistent as to level with the exemplar indicative descriptions of learning outcomes will consequently conform to the requirements of the National Qualifications Framework (NQF).

Therefore, following the University framework, the following table defines weight learning outcomes per award level with each learning outcome falling wholly into one of the categories of learning outcomes specified in the framework.

For the ordinary degree, the level at which the learning outcomes are achieved conform to a level intermediate between a Diploma in Higher Education (NQF level I) and an honours degree (NQF level H). The relevant learning outcomes for the ordinary degree are therefore taken as the level I learning outcomes with the addition of some elements of the learning outcomes from level H (those achievable through the successful completion of 60 Credits of non-project study at level H). The Ordinary Degree additions are indicated by italicised portions in the level H learning outcomes.

The award learning outcomes explicitly address the programme educational aims 1, 5, and 7.

Learning outcomes for computer games programming are as follows:

Common learning outcome headings	CERTIFICATE	INTERMEDIATE	HONOURS (additional BEng learning outcomes shown *italicised*)
Knowledge and Understanding	Demonstrate knowledge of underlying Computer Games Programming concepts and principles: • Programming fundamentals • Database systems and applications • Basic computing algorithms and algorithmic strategies • Techniques for computer system development, including requirements determination, analysis, logical and physical design, system implementation, and testing • Mathematical foundations for Computer Games Programming • Introductory graphics and games platform concepts • Introduction to principles of game engines	Demonstrate knowledge and critical understanding of Computer Games Programming concepts and principles that extend those covered at Certificate Level, in particular: • Advanced mathematical concepts including: linear algebra, calculus, numerical methods and graph theory • The issues, context and practices involved in working as a Computer Games Programming professional. • Advanced data structures and algorithms to support games programming techniques • Multiple processes and networks • Technical considerations for game development and execution + *For ordinary degree* • *Demonstrate development of high level techniques and strategies compatible with industry practice*	Demonstrate a systematic understanding of computing concepts and principles, building on those covered at Certificate and Intermediate Level, showing the acquisition of coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of Computer Games Programming research and development. Development of high level techniques and strategies compatible with industry practices, in particular • Real-time processes and data acquisition • Optimisation and performance analysis • Advanced game development concepts and techniques *In addition for the BEng:* *Understand the organisational and administrative principles of running a business and of systems of communication and control within*

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			organisations.
Learning	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Games Programming concepts and principles.	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Games Programming concepts and principles, while understanding the limits of individual knowledge and the consequences this has. *+ For ordinary degree* • *Recognise limitations of knowledge*	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Games Programming concepts and principles, while understanding the uncertainty, ambiguity and limitations of this knowledge
Enquiry	• Present, evaluate and interpret qualitative information and quantitative data. • Recognise the nature and extent of information needed, and be able to find it effectively and efficiently.	• Use recognised literature searching and requirements elicitation techniques to gather information about computer-based problems. • Critically evaluate and manage the information collected *+ For ordinary degree.* • *Recognise potential for ethical conflict in computer game development*	• Initiate and carry out projects within Computer Games Programming • Ethically gather information pertaining to Computer Games Programming problems, possible solutions, and the success of these solutions, from existing or potential users and/or organisations using software engineering techniques • Find, critically evaluate, manage, apply, and understand information from a range of sources, acknowledging the cultural, ethical, economic, legal, and social issues surrounding the use of information. *In addition for the BEng:* • *Critically evaluate current good practice, the roles of financial control, costing and marketing, and*

			the relation of costing, investment and resources to company and market environments • *Show initiative in the identification of problems, market opportunities and techniques and solutions.*
Analysis	• Evaluate and interpret the fundamental Computer Games Programming concepts and principles introduced at this Level. • Evaluate the appropriateness and functional qualities of computer-based systems	Use established investigation techniques to • analyse information pertaining to Computer Games systems and Computer Games Programming problems. • test and evaluate computer-based systems	Critically evaluate current research in Computer Games Programming, and critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete) to draw conclusions *In addition for the BEng:* • *Critically analyse data relating to costing, investment, and resources*
Problem Solving	Select and apply appropriate theory, practices and tools to develop Computer Games Programming-based solutions to problems.	• Assess critically the appropriateness of different approaches to solving Computer Games Programming-based problems. • Propose and develop solutions following analysis of Computer Games Programming-based problems. + *For ordinary degree.* • *Implement a plan fro the development of a small scale computer game*	• Develop appropriate questions and strategies to achieve a solution (or identify a range of solutions) to a Computer Games Programming-based problem. • Plan and carry out a large and complex Computer Games Programming project • Formulate strategies for the successful application of commercial and economic principles
Communication	• Communicate ideas and information accurately and reliably	• Communicate information effectively in a variety of forms	• Communicate ideas, problems and solutions to both specialist and non-

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			specialist audiences in a variety of forms
	• Document the development, design and testing of computer-based solutions in a structured manner.	• Communicate information effectively to specialist audiences using appropriate documentation techniques and report formats • Communicate ideas via recognised standards of documentation	• Write a structured formal report using appropriate referencing, and techniques for documentation. • Communicate and cooperate within small inter-disciplinary teams *In addition for the BEng:* • *Communicate effectively (and critically reflect on that communication) to develop and maintain both good teamwork and management functions.*
Application	Apply fundamental computing concepts and principles in the process of solving mathematical and computing-based problems	Apply, in previously unseen contexts, appropriate concepts, principles and techniques (including quantitative techniques) in the process of solving Computer Games Programming-based problems	Apply Computer Games Programming concepts, principles and techniques, including those at the forefront of Computer Games Programming knowledge, in the process of solving complex Computer Games Programming-based problems
Reflection	Demonstrate: • the ability to take responsibility for learning • the ability to work both independently and as team member.	Demonstrate an understanding of professional responsibility (including quality and safety issues); the ethical, legal and social context in which Computer Games Programming-based solutions are developed and operate; the need for continuing professional development and lifelong learning; the role of Computer Games Programming-based solutions and	Building on the understanding of professional and self-development issues developed at Certificate and Intermediate Level, work in a professional manner, recognising the legal, social, ethical and professional issues involved in the exploitation of computer technology, and being guided by the adoption of appropriate professional, ethical and legal

		systems within organisations; and the opportunities and skills needed for entrepreneurship.	practices. *In addition for the BEng:* • *Appreciate the need to take responsibility for the long-term effects of the engineering processes involved in the production of a product to defined quality criteria* • *Critically appraise technical and managerial contributions within an engineering project*

Learning outcomes for computer graphics are as follows:

Common learning outcome headings	CERTIFICATE	INTERMEDIATE	HONOURS
Knowledge and Understanding	Demonstrate knowledge of underlying Computer Graphics concepts and principles: • Programming fundamentals • Database systems and applications • Basic computing algorithms and algorithmic strategies • Techniques for computer system development, including requirements determination, analysis, logical and physical design, system implementation, and testing	Demonstrate knowledge and critical understanding of Computer Graphics concepts and principles that extend those covered at Certificate Level, in particular: • Advanced mathematical concepts including: linear algebra, calculus, numerical methods and graph theory • The issues, context and practices involved in working as a Computer Graphics professional. • Advanced data structures and	Demonstrate a systematic understanding of computing concepts and principles, building on those covered at Certificate and Intermediate Level, showing the acquisition of coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of Computer Graphics research and development. Development of high level techniques and strategies compatible with industry practices, in particular

	• Mathematical foundations for Computer Graphics • Introductory graphics and games platform concepts	algorithms to support graphics programming techniques • Enhanced image manipulation techniques • Techniques, structures and analysis of images + *For ordinary degree* • *Demonstrate development of high level techniques and strategies compatible with industry practice*	• Special effects and principles of colour • Low-level computer graphics concepts • Analysis techniques used in imaging *In addition for the BEng:* • *Understand the organisational and administrative principles of running a business and of systems of communication and control within organisations.*
Learning	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Graphics concepts and principles. [SRCA 4, 6; SRPA 2]	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Graphics concepts and principles, while understanding the limits of individual knowledge and the consequences this has. + *For ordinary degree* • *Recognise limitations of knowledge*	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Graphics concepts and principles, while understanding the uncertainty, ambiguity and limitations of this knowledge
Enquiry	• Present, evaluate and interpret qualitative information and quantitative data. • Recognise the nature and extent of information needed, and be able to find it effectively and efficiently.	• Use recognised literature searching and requirements elicitation techniques to gather information about computer-based problems. • Critically evaluate and manage the information collected. + *For ordinary degree*.	• Initiate and carry out projects within Computer Graphics • Ethically gather information pertaining to Computer Graphics problems, possible solutions, and the success of these solutions, from existing or potential users and/or

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		• *Recognise potential for ethical conflict in graphics software development*	organisations using software engineering techniques • Find, critically evaluate, manage, apply, and understand information from a range of sources, acknowledging the cultural, ethical, economic, legal, and social issues surrounding the use of information. *In addition for the BEng:* • *Critically evaluate current good practice, the roles of financial control, costing and marketing, and the relation of costing, investment and resources to company and market environments* • *Show initiative in the identification of problems, market opportunities and techniques and solutions.*
Analysis	• Evaluate and interpret the fundamental Computer Graphics concepts and principles introduced at this Level. • Evaluate the appropriateness and functional qualities of computer-based systems	Use established investigation techniques to • analyse information pertaining to Computer Games systems and Computer Graphics problems. • test and evaluate computer-based systems	Critically evaluate current research in Computer Graphics, and critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete) to draw conclusions *In addition for the BEng:* • *Critically analyse data relating to costing, investment, and resources*
Problem Solving	Select and apply appropriate theory, practices and tools to develop Computer Graphics-based solutions to problems.	• Assess critically the appropriateness of different approaches to solving Computer Graphics-based problems. • Propose and develop solutions	• Develop appropriate questions and strategies to achieve a solution (or identify a range of solutions) to a Computer Graphics-based problem.

		following analysis of Computer Graphics-based problems. + *For ordinary degree.* • *Implement a plan for the development of a small scale graphics application*	• Plan and carry out a large and complex Computer Graphics project
Communication	• Communicate ideas and information accurately and reliably • Document the development, design and testing of computer-based solutions in a structured manner.	• Communicate information effectively in a variety of forms • Communicate information effectively to specialist audiences using appropriate documentation techniques and report formats • Communicate ideas via recognised standards of documentation	• Communicate ideas, problems and solutions to both specialist and non-specialist audiences in a variety of forms • Write a structured formal report using appropriate referencing, and techniques for documentation. *In addition for the BEng:* • *Communicate effectively (and critically reflect on that communication) to develop and maintain both good teamwork and management functions.*
Application	Apply fundamental computing concepts and principles in the process of solving mathematical and computing-based problems	Apply, in previously unseen contexts, appropriate concepts, principles and techniques (including quantitative techniques) in the process of solving Computer Graphics-based problems	Apply Computer Graphics concepts, principles and techniques, including those at the forefront of Computer Graphics knowledge, in the process of solving complex Computer Graphics-based problems
Reflection	Demonstrate: • the ability to take responsibility for	Demonstrate an understanding of professional responsibility (including	Building on the understanding of professional and self-development

	learning • the ability to work both independently and as team member.	quality and safety issues); the ethical, legal and social context in which Computer Graphics-based solutions are developed and operate; the need for continuing professional development and lifelong learning; the role of Computer Graphics-based solutions and systems within organisations; and the opportunities and skills needed for entrepreneurship.	issues developed at Certificate and Intermediate Level, work in a professional manner, recognising the legal, social, ethical and professional issues involved in the exploitation of computer technology, and being guided by the adoption of appropriate professional, ethical and legal practices. *In addition for the BEng:* • *Appreciate the need to take responsibility for the long-term effects of the engineering processes involved in the production of a product to defined quality criteria* • *Critically appraise technical and managerial contributions within an engineering project*

Learning outcomes for Games Artificial Intelligence are as follows:

Common learning outcome headings	CERTIFICATE	INTERMEDIATE (ORDINARY DEGREE is Intermediate learning outcomes with the addition of the <u>*underlined italics*</u>	HONOURS (additional BEng learning outcomes shown *italicised*
Knowledge and Understanding	Demonstrate knowledge of underlying Games AI concepts and principles: • Programming fundamentals	Demonstrate knowledge and critical understanding of Game AI concepts and principles that extend those covered at Certificate Level, in	Demonstrate a systematic understanding of computing concepts and principles, building on those covered at Certificate and

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	• Database systems and applications • Basic computing algorithms and algorithmic strategies • Techniques for computer system development, including requirements determination, analysis, logical and physical design, system implementation, and testing • **Mathematical foundations for Game AI Programming** • **Introductory graphics and games platform concepts with reference to the use of Game AI** • **Introduction to principles of the engine architecture in Game AI.**	particular: • **Advanced mathematical concepts including: linear algebra, calculus, numerical methods and graph theory** • **The issues, context and practices involved in working as a Game AI Programming professional.** • **Advanced data structures and algorithms to support the development of AI engines** • **Navigation and cognition for game components** • **Technical considerations for game development and execution** + *For ordinary degree* • *Demonstrate development of high level techniques and strategies compatible with industry practice*	**Intermediate Level, showing the acquisition of coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of Game AI Programming research and development. Development of high level techniques and strategies compatible with industry practices, in particular** • **Emergent behaviour and characteristics** • **Advanced interpretive decision making** • **Advanced game development concepts and techniques** *In addition for the BEng:* *Understand the organisational and administrative principles of running a business and of systems of communication and control within organisations.*
Learning	**Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Games AI concepts and principles.**	**Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Game AI concepts and principles, while understanding the limits of individual knowledge and the consequences this has.**	**Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Game AI Programming concepts and principles, while understanding the uncertainty, ambiguity and limitations of this knowledge**

		+ For ordinary degree • *Recognise limitations of knowledge*	
Enquiry	• Present, evaluate and interpret qualitative information and quantitative data. • Recognise the nature and extent of information needed, and be able to find it effectively and efficiently.	• Use recognised literature searching and requirements elicitation techniques to gather information about computer-based problems. • Critically evaluate and manage the information collected *+ For ordinary degree.* • *Recognise potential for ethical conflict in computer game development*	• Initiate and carry out projects within the discipline of Game AI. • Ethically gather information pertaining to Game AI problems, possible solutions, and the success of these solutions, from existing or potential users and/or organisations using software engineering techniques • Find, critically evaluate, manage, apply, and understand information from a range of sources, acknowledging the cultural, ethical, economic, legal, and social issues surrounding the use of information. *In addition for the BEng:* • *Critically evaluate current good practice, the roles of financial control, costing and marketing, and the relation of costing, investment and resources to company and market environments* • *Show initiative in the identification of problems, market opportunities and techniques and solutions.*

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Analysis	• **Evaluate and interpret the fundamental Game AI concepts and principles introduced at this Level.** • **Evaluate the appropriateness and functional qualities of computer-based systems**	Use established investigation techniques to • analyse information pertaining to Game AI systems and problems. • test and evaluate computer-based systems	Critically evaluate current research in Game AI, and critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete) to draw conclusions *In addition for the BEng:* • *Critically analyse data relating to costing, investment, and resources*
Problem Solving	**Select and apply appropriate theory, practices and tools to develop Game AI-based solutions to problems.**	• **Assess critically the appropriateness of different approaches to solving Game AI-based problems.** • **Propose and develop solutions following analysis of Computer Games Programming-based problems.** + *For ordinary degree.* • *Implement a plan for the development of a small scale AI—based computer game*	• **Develop appropriate questions and strategies to achieve a solution (or identify a range of solutions) to a Games AI-based problem.** • **Plan and carry out a large and complex Game AI Programming project** • **Formulate strategies for the successful application of commercial and economic principles**
Communication	• **Communicate ideas and information accurately and reliably** • **Document the development, design and testing of computer-based solutions in a structured manner.**	• **Communicate information effectively in a variety of forms** • **Communicate information effectively to specialist audiences using appropriate documentation techniques and report formats** • **Communicate ideas via recognised standards of documentation**	• **Communicate ideas, problems and solutions to both specialist and non-specialist audiences in a variety of forms** • **Write a structured formal report using appropriate referencing, and techniques for documentation.** • **Communicate and cooperate within small inter-disciplinary teams**

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			In addition for the BEng: • *Communicate effectively (and critically reflect on that communication) to develop and maintain both good teamwork and management functions.*
Application	Apply fundamental computing concepts and principles in the process of solving mathematical and computing-based problems	Apply, in previously unseen contexts, appropriate concepts, principles and techniques (including quantitative techniques) in the process of solving Game AI-based problems	Apply Game AI concepts, principles and techniques, including those at the forefront of knowledge in the discipline, in the process of solving complex Game AI Programming-based problems
Reflection	Demonstrate: • the ability to take responsibility for learning • the ability to work both independently and as team member.	Demonstrate an understanding of professional responsibility (including quality and safety issues); the ethical, legal and social context in which Game AI-based solutions are developed and operate; the need for continuing professional development and lifelong learning; the role of Game AI-based solutions and systems within organisations; and the opportunities and skills needed for entrepreneurship.	Building on the understanding of professional and self-development issues developed at Certificate and Intermediate Level, work in a professional manner, recognising the legal, social, ethical and professional issues involved in the exploitation of computer technology, and being guided by the adoption of appropriate professional, ethical and legal practices. *In addition for the BEng:* • *Appreciate the need to take responsibility for the long-term effects of the engineering processes involved in the production of a*

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			• *product to defined quality criteria* • *Critically appraise technical and managerial contributions within an engineering project*

learning outcomes for Portable Games Programming are as follows

Common learning outcome headings	CERTIFICATE	INTERMEDIATE (ORDINARY DEGREE is Intermediate learning outcomes with the addition of the _underlined italics_)	HONOURS (additional BEng learning outcomes shown *italicised*)
Knowledge and Understanding	Demonstrate knowledge of underlying Computer Games Programming concepts and principles: • Programming fundamentals • Database systems and applications • Basic computing algorithms and algorithmic strategies • Techniques for computer system development, including requirements determination, analysis, logical and physical design, system implementation, and testing • Mathematical foundations for Computer Games Programming	Demonstrate knowledge and critical understanding of Portable Games Programming concepts and principles that extend those covered at Certificate Level, in particular: • Advanced mathematical concepts including: linear algebra, calculus, numerical methods and graph theory • The issues, context and practices involved in working as a Games Programming professional. • Technical considerations and techniques for game development and execution on portable devices. • _Demonstrate development of high_	Demonstrate a systematic understanding of computing concepts and principles, building on those covered at Certificate and Intermediate Level, showing the acquisition of coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of Portable Games Programming research and development. Development of high level techniques and strategies compatible with industry practices, in particular • Developing applications for multiple portable hardware and software platforms

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	• **Introductory graphics and games platform concepts** • **Introduction to principles of game engines**	*level techniques and strategies compatible with industry practice*	• **Optimisation techniques and performance analysis for restricted systems** • **Advanced handheld and mobile game development concepts and techniques** *In addition for the BEng:* • *Understand the organisational and administrative principles of running a business and of systems of communication and control within organisations.*
Learning	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Games Programming concepts and principles.	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Portable Games Programming concepts and principles, while understanding the limits of individual knowledge and the consequences this has. • *Recognise limitations of knowledge*	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Portable Games Programming concepts and principles, while understanding the uncertainty, ambiguity and limitations of this knowledge
Enquiry	• **Present, evaluate and interpret qualitative information and quantitative data.** • **Recognise the nature and extent of information needed, and be able to find it effectively and efficiently.**	• **Use recognised literature searching and requirements elicitation techniques to gather information about computer-based problems.** • **Critically evaluate and manage the information collected**	• **Initiate and carry out projects within Portable Games Programming** • **Ethically gather information pertaining to Portable Games Programming problems, possible**

		• *Recognise potential for ethical conflict in computer game development*	solutions, and the success of these solutions, from existing or potential users and/or organisations using software engineering techniques • Find, critically evaluate, manage, apply, and understand information from a range of sources, acknowledging the cultural, ethical, economic, legal, and social issues surrounding the use of information. *In addition for the BEng:* • *Critically evaluate current good practice, the roles of financial control, costing and marketing, and the relation of costing, investment and resources to company and market environments* • *Show initiative in the identification of problems, market opportunities and techniques and solutions.*
Analysis	• **Evaluate and interpret the fundamental Computer Games Programming concepts and principles introduced at this Level.** • **Evaluate the appropriateness and functional qualities of computer-based systems**	**Use established investigation techniques to** • **analyse information pertaining to Portable Games systems and Portable Games Programming problems.** • **test and evaluate computer-based systems**	**Critically evaluate current research in Portable Games Programming, and critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete) to draw conclusions** *In addition for the BEng:* • *Critically analyse data relating to*

			costing, investment, and resources
Problem Solving	Select and apply appropriate theory, practices and tools to develop Computer Games Programming-based solutions to problems.	• **Assess critically the appropriateness of different approaches to solving Portable Games Programming-based problems.** • **Propose and develop solutions following analysis of Portable Games Programming-based problems.** • ***Implement a plan for the development of a small scale Portable game***	• **Develop appropriate questions and strategies to achieve a solution (or identify a range of solutions) to a Portable Games Programming-based problem.** • **Plan and carry out a large and complex Portable Games Programming project** • **Formulate strategies for the successful application of commercial and economic principles**
Communication	• **Communicate ideas and information accurately and reliably** • **Document the development, design and testing of computer-based solutions in a structured manner.**	• **Communicate information effectively in a variety of forms** • **Communicate information effectively to specialist audiences using appropriate documentation techniques and report formats** • **Communicate ideas via recognised standards of documentation**	• **Communicate ideas, problems and solutions to both specialist and non-specialist audiences in a variety of forms** • **Write a structured formal report using appropriate referencing, and techniques for documentation.** • **Communicate and cooperate within small inter-disciplinary teams** *In addition for the BEng:* • ***Communicate effectively (and critically reflect on that communication) to develop and maintain both good teamwork and management functions.***

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Application	Apply fundamental computing concepts and principles in the process of solving mathematical and computing-based problems	Apply, in previously unseen contexts, appropriate concepts, principles and techniques (including quantitative techniques) in the process of solving Portable Games Programming-based problems	Apply Portable Games Programming concepts, principles and techniques, including those at the forefront of Portable Games Programming knowledge, in the process of solving complex Portable Games Programming-based problems
Reflection	Demonstrate: • the ability to take responsibility for learning • the ability to work both independently and as team member.	Demonstrate an understanding of professional responsibility (including quality and safety issues); the ethical, legal and social context in which Portable Games Programming-based solutions are developed and operate; the need for continuing professional development and lifelong learning; the role of Portable Games Programming-based solutions and systems within organisations; and the opportunities and skills needed for entrepreneurship.	Building on the understanding of professional and self-development issues developed at Certificate and Intermediate Level, work in a professional manner, recognising the legal, social, ethical and professional issues involved in the exploitation of computer technology, and being guided by the adoption of appropriate professional, ethical and legal practices. *In addition for the BEng:* • *Appreciate the need to take responsibility for the long-term effects of the engineering processes involved in the production of a product to defined quality criteria* • *Critically appraise technical and managerial contributions within an engineering project*

Learning outcomes for a **Multiplayer Online Games Programming** student are as follows:

Common learning outcome headings	CERTIFICATE	INTERMEDIATE (ORDINARY DEGREE is Intermediate learning outcomes with the addition of the _underlined italics_)	HONOURS (additional BEng learning outcomes shown _italicised_)
Knowledge and Understanding	Demonstrate knowledge of underlying Computer Games Programming concepts and principles: • Programming fundamentals • Database systems and applications • Basic computing algorithms and algorithmic strategies • Techniques for computer system development, including requirements determination, analysis, logical and physical design, system implementation, and testing • Mathematical foundations for Computer Games Programming • Introductory graphics and games platform concepts • Introduction to principles of game engines • Introduction to networking principles	Demonstrate knowledge and critical understanding of Multiplayer online Games Programming concepts and principles that extend those covered at Certificate Level, in particular: • Advanced mathematical concepts including: linear algebra, calculus, numerical methods and graph theory • The issues, context and practices involved in working as a Games Programming professional. • Technical considerations and techniques for game development and execution on multiplayer local and wide area networks. • Concurrency and control issues relating to multiplayer gameing • _Demonstrate development of high level techniques and strategies compatible with industry practice_	Demonstrate a systematic understanding of computing concepts and principles, building on those covered at Certificate and Intermediate Level, showing the acquisition of coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of Multiplayer online Games Programming research and development. Development of high level techniques and strategies compatible with industry practices, in particular • Developing applications for multiple multiplayer online hardware and software platforms • Optimisation techniques and performance analysis for distributed systems • Advanced multiplayer game development concepts and techniques

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			In addition for the BEng: • *Understand the organisational and administrative principles of running a business and of systems of communication and control within organisations.*
Learning	**Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Games Programming concepts and principles.**	**Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Multiplayer online Games Programming concepts and principles, while understanding the limits of individual knowledge and the consequences this has.** • ***Recognise limitations of knowledge***	**Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Multiplayer online Games Programming concepts and principles, while understanding the uncertainty, ambiguity and limitations of this knowledge**
Enquiry	• **Present, evaluate and interpret qualitative information and quantitative data.** • **Recognise the nature and extent of information needed, and be able to find it effectively and efficiently.**	• **Use recognised literature searching and requirements elicitation techniques to gather information about computer-based problems.** • **Critically evaluate and manage the information collected** • ***Recognise potential for ethical conflict in computer game development***	• **Initiate and carry out projects within Multiplayer online Games Programming** • **Ethically gather information pertaining to Multiplayer online Games Programming problems, possible solutions, and the success of these solutions, from existing or potential users and/or organisations using software engineering techniques** • **Find, critically evaluate, manage,**

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			apply, and understand information from a range of sources, acknowledging the cultural, ethical, economic, legal, and social issues surrounding the use of information. *In addition for the BEng:* • *Critically evaluate current good practice, the roles of financial control, costing and marketing, and the relation of costing, investment and resources to company and market environments* • *Show initiative in the identification of problems, market opportunities and techniques and solutions.*
Analysis	• **Evaluate and interpret the fundamental Computer Games Programming concepts and principles introduced at this Level.** • **Evaluate the appropriateness and functional qualities of computer-based systems**	**Use established investigation techniques to** • **analyse information pertaining to Multiplayer online Games systems and Multiplayer online Games Programming problems.** • **test and evaluate computer-based systems**	**Critically evaluate current research in Multiplayer online Games Programming, and critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete) to draw conclusions** *In addition for the BEng:* • *Critically analyse data relating to costing, investment, and resources*
Problem Solving	**Select and apply appropriate theory, practices and tools to develop Computer Games Programming-**	• **Assess critically the appropriateness of different approaches to solving Multiplayer**	• **Develop appropriate questions and strategies to achieve a solution (or identify a range of solutions) to a**

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	based solutions to problems.	online Games Programming-based problems. • Propose and develop solutions following analysis of Multiplayer online Games Programming-based problems. • *Implement a plan for the development of a small scale Multiplayer online game*	Multiplayer online Games Programming-based problem. • Plan and carry out a large and complex Multiplayer online Games Programming project • Formulate strategies for the successful application of commercial and economic principles
Communication	• Communicate ideas and information accurately and reliably • Document the development, design and testing of computer-based solutions in a structured manner.	• Communicate information effectively in a variety of forms • Communicate information effectively to specialist audiences using appropriate documentation techniques and report formats • Communicate ideas via recognised standards of documentation	• Communicate ideas, problems and solutions to both specialist and non-specialist audiences in a variety of forms • Write a structured formal report using appropriate referencing, and techniques for documentation. • Communicate and cooperate within small inter-disciplinary teams *In addition for the BEng:* • *Communicate effectively (and critically reflect on that communication) to develop and maintain both good teamwork and management functions.*
Application	Apply fundamental computing concepts and principles in the process of solving mathematical and computing-based problems	Apply, in previously unseen contexts, appropriate concepts, principles and techniques (including quantitative techniques) in the process of solving	Apply Multiplayer online Games Programming concepts, principles and techniques, including those at the forefront of Multiplayer online

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		Multiplayer online Games Programming-based problems	Games Programming knowledge, in the process of solving complex Multiplayer online Games Programming-based problems
Reflection	Demonstrate: • the ability to take responsibility for learning • the ability to work both independently and as team member.	Demonstrate an understanding of professional responsibility (including quality and safety issues); the ethical, legal and social context in which Multiplayer online Games Programming-based solutions are developed and operate; the need for continuing professional development and lifelong learning; the role of Multiplayer online Games Programming-based solutions and systems within organisations; and the opportunities and skills needed for entrepreneurship.	Building on the understanding of professional and self-development issues developed at Certificate and Intermediate Level, work in a professional manner, recognising the legal, social, ethical and professional issues involved in the exploitation of computer technology, and being guided by the adoption of appropriate professional, ethical and legal practices. *In addition for the BEng:* • *Appreciate the need to take responsibility for the long-term effects of the engineering processes involved in the production of a product to defined quality criteria* • *Critically appraise technical and managerial contributions within an engineering project*

The learning outcomes for a **Arcade Game and Simulator Development** student will be as follows:

Common learning outcome headings	CERTIFICATE	INTERMEDIATE (ORDINARY DEGREE is Intermediate learning outcomes with the addition of the _underlined italics_)	HONOURS (additional BEng learning outcomes shown _italicised_)
Knowledge and Understanding	Demonstrate knowledge of underlying Computer Games Programming concepts and principles: • Programming fundamentals • Database systems and applications • Basic computing algorithms and algorithmic strategies • Techniques for computer system development, including requirements determination, analysis, logical and physical design, system implementation, and testing • Mathematical foundations for Computer Games Programming • Introductory graphics and games platform concepts • Introduction to principles of interactive games and simulation	Demonstrate knowledge and critical understanding of Arcade game and simulator development concepts and principles that extend those covered at Certificate Level, in particular: • Advanced mathematical concepts including: linear algebra, calculus, numerical methods and graph theory • The issues, context and practices involved in working as a Games Programming professional. • Technical considerations and techniques for game development and execution on interactive devices. • Mechanisms for data capture and control by non-standard peripheral devices • _Demonstrate development of high level techniques and strategies compatible with industry practice_	Demonstrate a systematic understanding of computing concepts and principles, building on those covered at Certificate and Intermediate Level, showing the acquisition of coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of Arcade game and simulator development research and development. Development of high level techniques and strategies compatible with industry practices, in particular • Developing applications for multiple hardware and software platforms • Optimisation techniques and performance analysis for specialized systems • Advanced interaction and simulation development concepts and techniques _In addition for the BEng:_

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			• *Understand the organisational and administrative principles of running a business and of systems of communication and control within organisations.*
Learning	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Computer Games Programming concepts and principles.	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Arcade game and simulator development concepts and principles, while understanding the limits of individual knowledge and the consequences this has. • *Recognise limitations of knowledge*	Develop lines of argument and evaluate possible approaches, tools, techniques and solutions based on knowledge of underlying Arcade game and simulator development concepts and principles, while understanding the uncertainty, ambiguity and limitations of this knowledge
Enquiry	• Present, evaluate and interpret qualitative information and quantitative data. • Recognise the nature and extent of information needed, and be able to find it effectively and efficiently.	• Use recognised literature searching and requirements elicitation techniques to gather information about computer-based problems. • Critically evaluate and manage the information collected • *Recognise potential for ethical conflict in computer game development*	• Initiate and carry out projects within Arcade game and simulator development • Ethically gather information pertaining to Arcade game and simulator development problems, possible solutions, and the success of these solutions, from existing or potential users and/or organisations using software engineering techniques • Find, critically evaluate, manage, apply, and understand information

			from a range of sources, acknowledging the cultural, ethical, economic, legal, and social issues surrounding the use of information. *In addition for the BEng:* • *Critically evaluate current good practice, the roles of financial control, costing and marketing, and the relation of costing, investment and resources to company and market environments* • *Show initiative in the identification of problems, market opportunities and techniques and solutions.*
Analysis	• **Evaluate and interpret the fundamental Computer Games Programming concepts and principles introduced at this Level.** • **Evaluate the appropriateness and functional qualities of computer-based systems**	**Use established investigation techniques to** • **analyse information pertaining to Portable Games systems and Arcade game and simulator development problems.** • **test and evaluate computer-based systems**	**Critically evaluate current research in Arcade game and simulator development, and critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete) to draw conclusions** *In addition for the BEng:* • *Critically analyse data relating to costing, investment, and resources*
Problem Solving	**Select and apply appropriate theory, practices and tools to develop Computer Games Programming-based solutions to problems.**	• **Assess critically the appropriateness of different approaches to solving Arcade game and simulator development-based**	• **Develop appropriate questions and strategies to achieve a solution (or identify a range of solutions) to an Arcade game and simulator**

		- problems. - Propose and develop solutions following analysis of Arcade game and simulator development-based problems. *Implement a plan for the development of a small scale interactive game*	- development-based problem. - Plan and carry out a large and complex Arcade game and simulator development project - Formulate strategies for the successful application of commercial and economic principles
Communication	- Communicate ideas and information accurately and reliably - Document the development, design and testing of computer-based solutions in a structured manner.	- Communicate information effectively in a variety of forms - Communicate information effectively to specialist audiences using appropriate documentation techniques and report formats - Communicate ideas via recognised standards of documentation	- Communicate ideas, problems and solutions to both specialist and non-specialist audiences in a variety of forms - Write a structured formal report using appropriate referencing, and techniques for documentation. - Communicate and cooperate within small inter-disciplinary teams *In addition for the BEng:* *Communicate effectively (and critically reflect on that communication) to develop and maintain both good teamwork and management functions.*
Application	Apply fundamental computing concepts and principles in the process of solving mathematical and computing-based problems	Apply, in previously unseen contexts, appropriate concepts, principles and techniques (including quantitative techniques) in the process of solving	Apply Arcade game and simulator development concepts, principles and techniques, including those at the forefront of Arcade game and

		Arcade game and simulator development-based problems	simulator development knowledge, in the process of solving complex Arcade game and simulator development-based problems
Reflection	Demonstrate: • the ability to take responsibility for learning • the ability to work both independently and as team member.	Demonstrate an understanding of professional responsibility (including quality and safety issues); the ethical, legal and social context in which Arcade game and simulator development-based solutions are developed and operate; the need for continuing professional development and lifelong learning; the role of Aecade game and simulator development-based solutions and systems within organisations; and the opportunities and skills needed for entrepreneurship.	Building on the understanding of professional and self-development issues developed at Certificate and Intermediate Level, work in a professional manner, recognising the legal, social, ethical and professional issues involved in the exploitation of computer technology, and being guided by the adoption of appropriate professional, ethical and legal practice *In addition for the BEng:* • *Appreciate the need to take responsibility for the long-term effects of the engineering processes involved in the production of a product to defined quality criteria* • *Critically appraise technical and managerial contributions within an engineering project*

Section 5: Overall structure

For the sandwich Bachelor award the normal structure is four years with a two year programme studied at the University, followed by a one year industrial placement, and then a final year at the University. For the non-sandwich Bachelor awards the normal structure is three years studied at the University. Students may study in part-time mode as long as they observe the structure and general phasing of the full-time award.

The ordinary degree is only available to students after the end of level I or for direct entrants with suitable qualifications. An ordinary degree student will normally study one half year diet of modules (60 level H credits) that does not include the Honours project.

A level of study indicates the academic level at which study is to be undertaken – Certificate level (module level C), Intermediate level (module level I) and Honours level (module level H). Normally a level corresponds to one year of study for full-time students. For full-time students this is normally 120 credits per year. In the Computer Games programming award, each level consists of 105 credits of core or specific option modules that form the programme of study for a given award title at each level. In addition 15 credits must to be taken in the general option slot, either as a further specific credit module or as a general option module.

All awards have a set of modules at each level that are mandatory or core. All **core options** have to be passed because collectively they cover the learning outcomes for the award and therefore guarantee successful demonstration of the qualities needed to graduate in the particular award. In addition some optional modules are to be chosen from a specific list available for that award. These are referred to as **Award option**s. Each award will specify its own list of award options available for that award.

Computing options are ones which are from a more general list of options available to all computing students and belong to other computing schemes and awards.

The general option slot permits you to choose from a list of modules, some of which are outside the subject discipline of computing (e.g. some business modules or modern foreign language modules may be available as general options). This is to allow you to broaden your knowledge and skills base if you wish by taking some supplementary studies in addition to your main subject area.

More specifically a **General option** slot is where modules can be chosen from the modules on the University General Option list, excepting modules from the University IT Programme – provided the module has not already been taken and any module specific admission requirements are met.

The further study within computing that you could take within the general option slot includes modules from the list from an earlier level (so you can fill in some gaps from an earlier level if you want). However, please remember this is only when a module is being counted as your general option slot choice. Also, please again note that computing students are disqualified from taking modules on from the University IT Programme as general options (although you may always take them as additional modules - ask your level tutor about this).

If you study part-time then you will take 2 (or more) years to complete a level of study, although you cannot take more than 4 years per level and 8 years in total

for an honours degree. Please see the Undergraduate Modular Framework Regulations for further details.

In addition the scheme has a common set of **MEng learning outcomes.**

Upon entry to the MEng year a student would already have completed the equivalent of a BEng(Hons) award with a classification of at least a lower second. Thus the student would have already met the requirements of the award learning outcomes at the Honours level, and thus would also have met the requirements of the Computing Benchmark Statement.

The central core competency for anyone completing an MEng in the computing area is the ability to develop computing-based solutions to problems within the discipline of professional product development.

The learning outcomes thus do not directly extend or further develop the Level H learning outcomes.

Although the MEng permits students to express and further develop the expertise achieved at the Honours level, the specific subject content of that development is unspecified and moreover individual expertise is expressed and developed largely within the context of specific product development as part of the project, and thus cannot be relied upon to support content specific, rather than process oriented learning outcomes.

The MEng learning outcomes thus only address the discipline of professional product development of computing based products as solutions to problems, and do not address the further development of content specific expertise, but only its professional contextualisation and rigour of application.

The MEng learning outcomes must not be taken in isolation from the BEng learning outcomes for the appropriate award, which specify content specific expertise.

On completion of level M of the MEng, Staffordshire University students will be able to:-

Common learning outcome headings	Level M
Knowledge and Understanding	Demonstrate a systematic understanding of knowledge which is at the forefront of a given subject area of computing, as it pertains to the development of computing-based solutions to problems within the discipline of professional product development.
Learning	Demonstrate the independent learning ability required to advance knowledge and understanding, and to develop new skills to a high professional level.
Enquiry	Demonstrate a comprehensive understanding and critical evaluation of methodologies and techniques and the use of information from a range of sources applicable to research or advanced scholarship within a given subject area of computing, as it pertains to the development of computing-based solutions to problems within the discipline of professional product development.
Analysis	Demonstrate a critical awareness and evaluation of current research, advanced scholarship, contemporary problems and/or new insights

	within a given subject area of computing, as it pertains to the development of computing-based solutions to problems within the discipline of professional product development.
Problem Solving	Apply professional judgement systematically and creatively (often in the absence of complete data) and employ appropriate decision-making to solve complex problems required in the development of computing based systems.
Communication	Demonstrate effective and efficient use of communication skills to communicate conclusions clearly to specialist and non-specialist audiences.
Application	Apply good practice, and established and novel techniques within a given subject area of computing, based on critical awareness and evaluation of current research, and advanced scholarship in the planning and development of computing based solutions to problems.
Reflection	Demonstrate the qualities and transferable skills necessary for employment requiring the exercise of initiative and personal responsibility, self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional level and be able to critically evaluate their own contribution within the product development cycle and use that criticism effectively.

A Study Skills module with no CAT points attributed will be offered to all scheme students covering a range of activities and seminars relating to general study skills. This will be delivered in a weekly 1 hour slot in the first semester only.

Section 6: Individual Award Structures

6.1 Computer Games Programming

LEVEL C	Introduction to Software Development	Hardware & Software Systems & Networks[1]	Maths & Statistics for Computing[2]	Introduction to Computer Games and Graphical Systems
	Object Oriented and Event Driven Programming	Systems Analysis and Database Design	Introduction to Programming 3D Graphics Applications	General Option

LEVEL I	Professional & Enterprise Development	Further Programming For 3D Applications	Windows Game Programming	Award Option
	Mathematics and Algorithms	Programming Physics and AI engines for Games	Award Option	General Option

AWARD OPTIONS one from:

Title: Computer Games Programming & Graphics Student Handbook   20/08/2007
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Semester 1
Further Programming Concepts in C++
Further Object-Oriented Programming
Computer Graphics

And **one** from

Semester 2
System Programming and Computer Control Systems
Concurrent Programming in c#
AI Methods

If you are registered for a sandwich degree you must do an industrial placement between levels I and H, usually lasting one year.

LEVEL H	Computing Project: Planning, Management, Communication & Appraisal	3D Computer Graphics	Award Option [Information Systems Engineering in Industry]**	General Option
	Computing Project: Research, Analysis & Artefact Design	Computing Project: Realisation, Testing & Evaluation	Award Option	Award Option

**BEng level 3 structure has additional core in []

AWARD OPTIONS one from:
Semester 1

Practical Game Strategies
Advanced programming for 3D Applications
Artificial Intelligence Engines for Games
Further Artificial Intelligence

and two from

Semester 2
Real-Time Rendering and Animation
Advanced Windows game programming
Character AI
Low Level Graphics Concepts

Computing Option (any computing module at given level from any semester subject to meeting admissions requirements and to requirement that 60 credits are the normal maximum number of credits taken by a full-time student in a given semester).

*The **Ordinary degree** of this title at level H consists of 60 level 3 credits, the structure of which is defined to be those 60 credits that remain from the structure of the Honours degree at level H, after the 45 credit project and the 15 credit general option have been excluded.

LEVEL M	MEng Project	MEng Project	Personal Development and Research Methods	Negotiated Study
	MEng Project	MEng Project	Negotiated Study	Negotiated Study

6.2 Computer Graphics

LEVEL C	Introduction to Software Development	Hardware & Software Systems & Networks[1]	Maths & Statistics for Computing[2]	Introduction to Computer Games and Graphical Systems
	Object Oriented and Event Driven Programming	Systems Analysis and Database Design	Introduction to Programming 3D Graphics Applications	General Option

LEVEL I	Professional & Enterprise Development[4]	Further Programming For 3D Applications	Computer Graphics	Computing Option
	Mathematics and Algorithms	Imaging an Special Effects	Award Option	General Option

AWARD OPTIONS one from:
Semester 2
AI Methods
Programming Physics and AI Engines for Games

If you are registered for a sandwich degree you must do an industrial placement between levels I and H, usually lasting one year.

LEVEL H	Computing Project: Planning, Management, Communication & Appraisal	3D Computer Graphics	Image Processing Computer Vision and Pattern Recognition	Award Option [Information Systems Engineering in Industry]**
	Computing Project: Research, Analysis & Artefact Design	Computing Project: Realisation, Testing & Evaluation	Real-Time Rendering and Animation	General Option

**BEng level 3 structure has additional core in []

AWARD OPTIONS one from:

Semester 1

Chaos and Fractals
Advanced programming for 3D Applications
Artificial Intelligence Engines for Games
Further Artificial Intelligence

Computing Option (any computing module at given level from any semester subject to meeting admissions requirements and to requirement that 60 credits are the normal maximum number of credits taken by a full-time student in a given semester).

*The **Ordinary degree** of this title at level H consists of 60 level 3 credits, the structure of which is defined to be those 60 credits that remain from the structure of the Honours degree at level H, after the 45 credit project and the 15 credit general option have been excluded.

LEVEL M			
MEng Project	MEng Project	Personal Development and Research Methods	Negotiated Study
MEng Project	MEng Project	Negotiated Study	Negotiated Study

6.3 Games Artificial Intelligence

LEVEL C			
Introduction to Software Development	Hardware & Software Systems & Networks[1]	Maths & Statistics for Computing[2]	General Option
Object Oriented and Event Driven Programming	Systems Analysis and Database Design	Introduction to Programming 3D Graphics Applications	Introduction to AI

LEVEL I			
Professional & Enterprise Development[4]	Decision Theory and Cybernetics	Windows Game Programming	Award Option
Mathematics and Algorithms	Programming Physics and AI engines for Games	AI Methods	General Option

AWARD OPTIONS one from:
Semester 1
Further Programming for 3D Applications

Further Programming Concepts in C++
Computer Graphics

If you are registered for a sandwich degree you must do an industrial placement between levels I and H, usually lasting one year.

LEVEL H	Computing Project: Planning, Management, Communication & Appraisal	Artificial intelligence for games	Award Option [Information Systems Engineering in Industry]**	General Option
	Computing Project: Research, Analysis & Artefact Design	Computing Project: Realisation, Testing & Evaluation	Strategic and Tactical Thinking for games	Character AI

****BEng** level 3 structure has additional core in []

AWARD OPTIONS one from:
Semester 1

Advanced programming for 3D Applications
Further Artificial Intelligence
Practical Game Strategies
Advanced Windows Game Programming

Computing Option (any computing module at given level from any semester subject to meeting admissions requirements and to requirement that 60 credits are the normal maximum number of credits taken by a full-time student in a given semester).

*The **Ordinary degree** of this title at level H consists of 60 level 3 credits, the structure of which is defined to be those 60 credits that remain from the structure of the Honours degree at level H, after the 45 credit project and the 15 credit general option have been excluded.

LEVEL M	MEng Project	MEng Project	Personal Development and Research Methods	Negotiated Study
	MEng Project	MEng Project	Negotiated Study	Negotiated Study

6.4 Portable Games Programming

LEVEL C	Introduction to Software Development	Hardware & Software Systems & Networks[1]	Maths & Statistics for Computing[2]	Introduction to Games and Graphical Systems
	Object Oriented and Event Driven Programming	Systems Analysis and Database Design	Introduction to Programming 3D Graphics Applications	General Option

LEVEL I	Professional & Enterprise Development[4]	Windows Game Programming	Award Option	Computing Option
	Mathematics and Algorithms	Programming Physics and AI engines for Games	Programming for Mobile and Handheld devices	General Option

AWARD OPTIONS one from:
Semester 1
Further Programming Concepts in C++
Further Object-Oriented Programming
Further Programming for 3D Applications
Fundamentals of Mobile Computing

If you are registered for a sandwich degree you must do an industrial placement between levels I and H, usually lasting one year.

LEVEL H	Computing Project: Planning, Management, Communication & Appraisal	Advanced Windows Game Programming	Further Programming for Mobile and Handheld Devices	Computing Option [Information Systems Engineering in Industry]**
	Computing Project: Research, Analysis & Artefact Design	Computing Project: Realisation, Testing & Evaluation	Software Techniques for Restricted Systems	General Option

**BEng level 3 structure has additional core in []

Computing Option (any computing module at given level from any semester subject to meeting admissions requirements and to requirement that 60 credits are the normal maximum number of credits taken by a full-time student in a given semester).

*The **Ordinary degree** of this title at level H consists of 60 level 3 credits, the structure of which is defined to be those 60 credits that remain from the structure of the Honours degree at level H, after the 45 credit project and the 15 credit general option have been excluded.

LEVEL M	MEng Project	MEng Project	Personal Development and Research Methods	Negotiated Study
	MEng Project	MEng Project	Negotiated Study	Negotiated Study

6.5 Multiplayer Online Games Programming

LEVEL C	Introduction to Software Development	Hardware & Software Systems & Networks[1]	Maths & Statistics for Computing[2]	General Option
	Object Oriented and Event Driven Programming	Systems Analysis and Database Design	Introduction to Programming 3D Graphics Applications	Introduction to Networking with LANs and WANs

LEVEL I	Professional & Enterprise Development[4]	Further Programming For 3D Applications	Award Option	General Option
	Mathematics and Algorithms	Programming Physics and AI engines for Games	Network and Grid Computing	Award Option

AWARD OPTIONS one from:
Semester 1
On-Line Gaming
LAN switching and WAN networks
Web Database Programming

one from:
Semester 2
Concurrent Programming in C#
Systems programming and Computer Control Systems

If you are registered for a sandwich degree you must do an industrial placement between levels I and H, usually lasting one year.

LEVEL H	Computing Project: Planning, Management, Communication & Appraisal	Multiplayer Game Software Engineering	Award Option	Award Option [Information Systems Engineering in Industry]**
	Computing Project: Research, Analysis & Artefact Design	Computing Project: Realisation, Testing & Evaluation	Character AI	General Option

BEng level 3 structure has additional core in []

AWARD OPTIONS two from:
Semester 1
Advanced programming for 3D Applications
Practical Game Strategies
Advanced Windows Game Programming
Narrative for Massively Multiplayer Online Games

Computing Option (any computing module at given level from any semester subject to meeting admissions requirements and to requirement that 60 credits are the

normal maximum number of credits taken by a full-time student in a given semester).

*The **Ordinary degree** of this title at level H consists of 60 level 3 credits, the structure of which is defined to be those 60 credits that remain from the structure of the Honours degree at level H, after the 45 credit project and the 15 credit general option have been excluded.

LEVEL M	MEng Project	MEng Project	Personal Development and Research Methods	Negotiated Study
	MEng Project	MEng Project	Negotiated Study	Negotiated Study

6.6 Arcade Game and Simulator Development

LEVEL C	Introduction to Software Development	Hardware & Software Systems & Networks[1]	Maths & Statistics for Computing[2]	Introduction to Interactive Games and Simulation
	Object Oriented and Event Driven Programming	Systems Analysis and Database Design	Introduction to Programming 3D Graphics Applications	General Option

LEVEL I	Professional & Enterprise Development[4]	Further Programming For 3D Applications	Further Interactive Games and Simulation	Award Option
	Mathematics and Algorithms	Programming Physics and AI Engines for Games	System Programming and Computer Control Systems	General Option

AWARD OPTIONS one from:
Semester 1
Windows Game Programming
Further Programming Concepts in C++

If you are registered for a sandwich degree you must do an industrial placement between levels I and H, usually lasting one year.

LEVEL H	Computing Project: Planning, Management, Communication & Appraisal	Advanced Simulator Design and Development	Award Option	Award Option [Information Systems Engineering in Industry]**
	Computing Project: Research, Analysis & Artefact Design	Computing Project: Realisation, Testing & Evaluation	Low-level Graphics Concepts	General Option

**BEng level 3 structure has additional core in []

AWARD OPTIONS two from:
Semester 1
Advanced programming for 3D Applications
Advanced Windows Game Programming
Practical Game Strategies

Computing Option (any computing module at given level from any semester subject to meeting admissions requirements and to requirement that 60 credits are the normal maximum number of credits taken by a full-time student in a given semester).

*The **Ordinary degree** of this title at level H consists of 60 level 3 credits, the structure of which is defined to be those 60 credits that remain from the structure of the Honours degree at level H, after the 45 credit project and the 15 credit general option have been excluded.

LEVEL M	MEng Project	MEng Project	Personal Development and Research Methods	Negotiated Study
	MEng Project	MEng Project	Negotiated Study	Negotiated Study

Section 7: Employability

The award aims to foster the knowledge and skills necessary to maximise your employability. It does so in line with the Universities Employability policy (see Appendix A). It addresses employment and career development skills in the level I Professional and Enterprise Development module (covering such topics as recruitment processes and interviews, self-employment options and career planning).

All students on a sandwich award undertake a mandatory period of industrial work experience, where the student is expected to engage in professionally valid work. This is usually during the third year, following completion of level I studies. This is normally a salaried year, the company employer paying any such students for their work.

During this period, considerable experience of the practical application of the theoretical topics underpinning the various awards is obtained. This direct and responsible experience of work greatly enhances your employability.

You are expected to reflect upon that experience to enhance your general as well as specific employment skills. The process of finding a placement involves you in the completion of CVs, applications, interviews and the whole employment selection process, thus providing excellent experience ahead of the final year.

Entrepreneurship

The University is aware that some of its students would wish to start their own business on leaving the University. The University wishes to support this aspiration as far as it can and therefore offers a number of business modules which may be taken as general options which explicitly address enterprise skills and knowledge.

BLB10085-1 Enterprise for Non-Business Learners

BLB10086-2 Enterprising Management

BLB10006-3 Strategic Entrepreneurship

For more details see the module description website

http://www.staffs.ac.uk/current/student/modules/

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Section 8: Personal Development Planning (PDP)

Personal Development Planning (PDP) is a set of activities and an approach to your studies which the University wants to encourage all students to engage in. Essentially, it encourages you to reflect on your life and career goals and expectations, in order to analyse what skills and knowledge you need in order to accomplish those goals. It encourages you to try to integrate your academic studies with the rest of your life and aims to try to help you appreciate the relevance and context of your studies. It also will try to help you become equipped with the set of skills that will help you take a more proactive approach to your life and the place of academic study and lifelong learning within it.

Personal Development Planning (PDP) has been embedded within the award in a number of different ways:

§ At level C it is largely embedded in the personal tutor's role. It is coupled with the process of induction and later in the year with the need to firm up on the choice of modules for the second year.

§ At level I, the Professional and Enterprise Development module explicitly requires you as part of your developing professionalism, to reflect upon your career/life goals and what actions and learning objectives you need to pursue in order to facilitate the achievement of those goals.

§ In the industrial placement there is an explicit requirement to reflect upon the placement experience and relate it to your personal development.

§ Finally, at level H, the project supervisor's role will include facilitating your reflection upon your development in the final year ahead of progression into employment, research or training.

Please refer to the materials and resources you were handed out/introduced to during your induction period for additional practical advice.

Section 9: Flexible study arrangements

It is recognised that the award's provisions need to be placed within a wider context defined by the University and its mission to facilitate access to its courses by as many as possible of those who might benefit from them. Thus the award needs to try and ensure that conventional structures should not prevent as far as is practicable the ability of individuals to engage with the learning and assessment activities required.

A number of developments facilitate this aspiration.

Modules may adopt a zoned timetable for the lectures and a number of the practical/tutorials for the module. This implies that part-time students will be able to concentrate their need to attend classes during the day to one day per week. This facilitates part-time attendance on a day release basis. However, whether a given module is zoned as described above will depend upon demand for the module from part-time students.

The Faculty is committed to the continued extension to the use of VLEs to all the modules across the Faculty (and by implication all the modules taken by students on the Computer Games programming award). The extension of the use of VLEs to support delivery on campus facilitates the gradual introduction of blended learning strategies across the delivery of modules. A blended approach integrates e-learning technology elements into a wider learning and development framework where a combination or 'blend' of different learning approaches is used, and where the choice of technique is governed by both the pedagogical requirements of the learning outcomes to be achieved and the backgrounds of the learners. A blended learning strategy in turn facilitates the learning support that can be provided to students who need to study using less traditional patterns. While blended delivery may still require attendance in classes for part of the blend of delivery it reduces the reliance upon classroom delivery and thus is more attractive to, and sustainable by, the less traditional student. This, however, is not at the expense of more traditional students who would also receive the same blended delivery as part of their experience of the module i.e. this approach does not fragment delivery between full-time and part-time. This permits full-time provision to support the development of materials for students studying by less traditional routes. However, it must be recognised that the development of a more blended learning strategy for flexible delivery is constrained by the pace of development of alternative delivery methods as characterised by the use and uptake of VLEs.

The Award adopts a flexible approach to the timing of entry to the Award. In general applicants may apply for admission to the Award at any level. They will need to meet any entry requirements (see Section 19 for details). The Award permits applicants who have met the admissions requirements for entry to level I or level H of the award to commence their study at the start of the second teaching block as well as the first.

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Section 10: Industrial placement

If you are on a sandwich award then the third year of your award will normally be spent in employment within the computing profession in one of the hundreds of companies who have links with the University. Some are large blue chip companies others are small independent firms which are spread all over the country. There are a few placements in Europe. Over the years students have managed to find work all over the world. The Faculty has a Placement Office that will help you to get your placement organised. Their responsibility is to act as a link between you and organisations that are willing to take students on a placement. They will advertise vacancies and advise you on your CV, etc. You must contact them to apply for any position that they advertise. Firms have their own methods for dealing with applications. You will be invited for interview and may find yourself competing not only with your fellow students, but also with students from other institutions. Obviously, it is up to you to get the job! The majority of these placements are paid so you will be earning a decent salary perhaps for the first time. You have to work for at least 48 weeks in continuous employment and are required to produce a report at the end of your placement which forms part of your assessment. You are allocated a Faculty tutor who will visit you normally twice a year to keep track of your progress.

http://www.staffs.ac.uk/fcet/placements

Industrial placement learning outcomes

The role of the placement is to provide those of you who undertake it with an opportunity to broaden and deepen your experience of the development of computing-based solutions to problems and to do so in a professional context. This permits you to consolidate a number of level I learning outcomes and thus improve your preparedness for level H.

The placement does not have an identified credit level or credits associated with it. Thus the learning outcomes for the placement do not relate to a credit level.

Given that the placement occurs after level I, no level I and thus no DipHE learning outcomes can be dependent upon the placement. Also given that non-sandwich versions of the awards are available, then the level H learning outcomes cannot be made to depend upon the completion of a placement. Thus the learning outcomes for the placement do not contribute to the award learning outcomes.

The wide variety of placement organisations and placement job roles makes it impossible to be sufficiently prescriptive over your specific learning experiences as to be able to guarantee support for learning outcomes in pre-defined elements or areas of computing. The learning outcomes for the industrial placement thus focus on the organisational and professional context of the placement, rather than on the development of subject specific expertise.

The following are the industrial placement learning outcomes:

1   Understand and apply the methods employed in, and the constraints and requirements imposed on, the development and use of computing systems within an organisation.

2 Exercise professional judgement based on an understanding of both technical and non-technical issues relevant to the development and use of computing based systems in an organisation

3 Understand the need for, and develop proper, professional inter-personal relationships and comply to the work discipline and legitimate expectations of an organisation.

4 Relate the practices of a real organisation to the principles and concepts of computing.

Assessment of the industrial placement

In order to qualify for the award of a sandwich Honours degree the industrial placement period must be passed.

Failure in the industrial placement will require a repeat of an industrial placement as a referral. Only one referral attempt is allowed and must normally occur within 18 months.

To pass the industrial placement a student must have,

1 completed, normally, 48 weeks of relevant work experience (32 weeks for Bridging course students),

2 achieved at least 40% in the placement report

3 achieved an aggregate mark of 40% or more.

Where the aggregate mark achieved by a student is ≥ 40%, but either of the pass criteria 1 or 2 above are not fulfilled, then the grade point recorded will be a 3.

The industrial placement cannot be subject to compensation.

Progression and the industrial placement

If you are registered on a sandwich award then normally, in order to progress onto level H you must pass the industrial placement, in addition to fulfilling any other criteria specified by the University Undergraduate Modular Framework regulations. However, exceptionally you may be allowed to proceed onto level H without completing an industrial placement. You will still be required to pass an industrial placement before you can be awarded a sandwich Honours degree.

Section 11: Final year project

During your studies, you will be introduced to several new skills, many of which are designed to help you with your final year project. You will also find that your work experience is invaluable. Your project will be one of the most important assessments of your degree. To start with, it is yours, often conceived by you, certainly developed and progressed by you. It is nothing to fear as it will become something you will be very proud of and eager to demonstrate and present to prospective employers. Full details of the requirements and assessment of the project are contained in a separate handbook.

The final year project is seen as a very significant component of your final year studies. As such the Award Board tends to treat the project modules differently from other modules at level H. In particular, these programme specific regulations mean that Award Boards **will limit the maximum degree classification that you can achieve on a resit if you were to fail some of your project modules and will apply compensation to project modules less generously than it might do elsewhere**. You should read the regulations that relate to the project and **you need to bear this in mind when allocating your effort between your final year modules**.

All information regarding the Final Year Project can be found on the intranet site:

http://www.fcet.staffs.ac.uk/projector/

You are able to choose your project and wherever possible an appropriate supervisor, with whom you will arrange regular (normally weekly) progress meetings. Projects are second assessed by another academic to ensure consistency. The project manager will provide advice and guidance should problems arise that cannot be solved between yourself and your project supervisor or second assessor.

Although it is appreciated that students will come to the project with varying levels of previous knowledge and skills, work on the production of the project artefact and the project documentation (including artefact support documentation) will only be credited if it is carried out while you are registered for the project modules. Any such work should be referenced in the normal way.

General requirements and expectations of the project

The development and expression of a computing based solution to a problem

Essential to the project is that it should be constituted by the development and expression of a computing based solution to a problem. Some form of implementation is, therefore, required, and moreover for a computer games programming student the implementation of a computing based solution to a problem should involve the expression of that solution (or significant parts of it) in the form of an algorithm encoded in whatever language is suitable. The language may be of whatever generation and include scripting languages, macro languages and declarative/functional or graphical languages, as long as the language permits the expression of algorithms of appropriate generality and complexity.

The project has to do with the development of computing based solutions to problems. What makes a solution computing based is **not** the medium on which the implemented solution (the artefact) exits i.e. it is **not** a computing based solution to a problem simply because the artefact runs on a computer. What makes a solution computing based is the requirement that the solution as developed and expressed by the student is a computing solution i.e. that it involves centrally the expression of the solution in the form of an effective procedure (or a mathematical equivalent). The concept of an effective procedure (algorithm) is the central core concept that constitutes the fundamental defining characteristic of computing. To express the solution primarily in any other form makes the expression of the solution something else other than computing - it may be engineering, it may be technological design, it may be art and design, but what it definitely is not, is computing.

Thus simply constructing an artefact by using packages is not sufficient. Such solutions are built, but are not algorithmic unless the constructive process is itself specified by an algorithm (and this is different from the target functionality having a specification). Such an artefact may run on a computer, but the creation of the artefact as such is not computing and is not sufficient for a computing project.

It should be noted that the requirements for the project expected within the Computer Games programming award, is independent of any expectations that accrediting bodies such as the British computer Society may have.

The level of intellectual demand required

For the project, the problem and the computing based solution need to be appropriate for level H in terms of the intellectual skills required to complete it i.e. it has to be of sufficient complexity for an honours project. As a guide, it is reasonable to say that the project should be something in terms of difficulty that someone could only be expected to start after having studied computing for 2 years full-time at a University, and requires from such a person 45 Credits worth of work to complete. If it can be done as a whole, or individual modules that constitute it can be done, to the same standard, by an enthusiastic amateur, who is self-taught from a few books/the

internet, etc, then it is not adequate as an honours project. Projects are intended to express the achievement of someone who is on the verge of becoming a computing professional, and not the achievement of a hobbyist.

The issue of standards is an important qualifier however. A keen amateur may attempt to produce a software artefact of a type that a student may also produce legitimately as part of their final year project. However, in such circumstances the computing student should produce an artefact close to a professional standard, whereas the artefact produced by an amateur would be significantly flawed. I would expect that the amateur's work would fail as an expression of both academic and professional competence.

The key test as to whether something may be adequate as a project is the question: Could a project or given specific component modules be undertaken to the expected standards (both professional and academic) by someone without the education in computing that students on the Computer Games programming award have received? If the answer to this question is yes, then the project is inadequate and needs to be rejected or enhanced in suitable ways in order to make it acceptable.

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Section 12: Opportunities for flexible transfer to other awards

The Faculty of Computing, Engineering and Technology offer a number of awards in computing and computing related fields as well as awards in technological areas that may be of interest to students who have broadly technical interests. It may become apparent that you have made a mistake in your choice of award. You may feel that an award with greater business coverage would suit you better, or one that focuses on various media technologies and their application, or you need something with more substantial low level electronic hardware content. In these cases you may be able to transfer to an award in the Business Faculty or to one of the awards in the technology or engineering areas offered by the Faculty. Some of these awards have modules in common with the Computer Games programming and Graphics awards, thus you may be able to use some of the modules that you have already passed as counting towards the achievement of the relevant award.

If you feel that you may have made a mistake over the general area of study, then you are advised in the first instance to **contact your personal tutor or the Student Advisor** who can then discuss with you various options for transfer to other awards, should you wish to do so.

Section 13: Learning

The University and the Faculty of Computing, Engineering and Technology, as a whole are mindful of the demands being made by a large number of students and increasingly diverse cohorts.

The University has a policy aimed at ensuring that you have opportunities to develop the study skills and outlook necessary to support your currency with the subject studied throughout a future career. The University teaching and learning strategy aims to create a resource based learning environment, with an emphasis on student opportunity for learning rather than simple directed teaching. Each student is a partner in the learning experience, and is expected to take responsibility for his/her study. As a result the Faculty sees the role of lecturer as a learning facilitator.

The resource based approach to facilitating your learning is enhanced by the availability of on-line learning facilities such as VLEs or websites. Both of these are already used extensively across the Faculty. However, it is the policy of the Faculty to make the use of some form of VLE universal.

You are encouraged to undertake independent learning to extend the material presented. The value of self-gained knowledge and understanding is emphasised, both as an essential skill/practice for life (lifelong learning) and as an expectation on computing professionals (continuing professional development).

The following are points to be considered by you:

§   always remember - learning is about you doing things, not having them done to you

§   manage your time - get yourself to the right session at the right time

§   use and look after learning materials and bring them to the appropriate sessions - replacements are not always available

§   get used to using the library and other learning resources, independently

§   if you don't understand something - ask

§   please respect staff privacy - they may operate an appointment system

§   be flexible in your thinking

The University will provide:

§   a learning environment that is appropriate for each module

§   feedback on your work

§   guidance and direction in your studies

§   advice on study techniques

§   support with your use of educational resources and materials

§   help in pointing you in the right direction if you have personal problems

§   all round support for your growth as an independent learner

§   a variety of methods of course presentation

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Throughout all your studies, you will be introduced to differing study skills. Special care has been taken in the design, particularly of the Level C modules, to ensure you are provided with the right foundation for you to take advantage of all methods of delivery, assessment and study.

Study Skills

This Handbook cannot act as a manual on study skills. However, the following books are recommended to you:

§   Rowntree, Derek, *Learn How To Study: A Guide for Students of All Ages*, Time Warner Paperbacks, 1998, ISBN: 0751520888.

§   Cottrell, Stella, *The Study Skills Handbook*, Palgrave Macmillan, 2003, ISBN: 1403911355.

Section 14: Organisation of independent study time

Each module has a total number of learning hours associated with it. For a 15 Credit module this is 150 hours (it is worked out at 10 hours per credit). These learning hours are intended to give an indication of the total number of hours that are likely to be involved in studying and completing the assessment for a given module. However, some of you may need to spend more time than the hours indicated (some may spend need to spend less), largely depending on your prior familiarity and level of competence with the skills and knowledge required as an admission's requirement for the module, or actually covered by the module.

Out of these total learning hours some of the hours will have been allocated to class contact (lectures, tutorials, practicals, etc.). However, the bulk of the learning hours will be given over to independent (non-class contact) learning activity (which includes assessments and preparation for them). It is up to you to plan the time available and allocate appropriate amounts of time to the various activities you must do for the module.

Example time allocation:

The following is intended to be an example of how you could allocate time among the different activities for a typical 15 Credit module (with 36 hours of class contact at 3 per week, 50% assignment, 50% 2 hour exam). However, the exact allocation of hours is dependent upon you and the module you are taking.

Total learning hours = 150 hours. Subtracting 36 hours for class contact, gives 114 hours for independent activity. 2 hours is given to the exam, leaving 112 hours which you need to allocate between,

i) exam preparation;

ii) assignment completion;

iii) weekly lecture/tutorial/practical preparation, reading and exercise completion.

Please note that in the following **work hours** are taken as hours of productive work and not total elapsed time between starting and finishing some task e.g. coffee, meal, comfort and relaxation breaks and breaks for any other activity are not included.

You could allow 48 work hours in total for the weekly work on the material covered in the lectures, tutorials, practicals for that week – associated reading, note-taking, completion of tutorial/practical exercises, etc. This gives you 4 work hours to be spent each week (in addition to the class hours) working on the material being covered that week.

This leaves 64 hours for the assessment. This could be divided into 32 work hours of exam revision (= 4 ½ days of full-time work on revision) and 32 work hours spent on the assignment (= 4 ½ days of full-time work on the assignment).

There is of course a trade-off in the allocation of time between the various different activities. To a large extent if you decide not to give much time to the weekly lecture/tutorial/practical material, then your level of understanding of the material will be much poorer when it comes to the revision for the exam. This would require you to spend many more hours in exam revision to achieve the same level of preparedness as you would have achieved had you spent some significant

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proportion of your time on the weekly work. Similarly, the completion of the assignment activities would normally be facilitated by having achieved a foundation of knowledge, understanding and skills in the weekly work. Thus if you were to allocate 0 hours to the weekly work in addition to the class contact time, then it may be possible that you would need to spend an additional 24 work hours on revision for the exam (= almost 3 ½ days of full-time exam revision) and 24 work hours on the assignment (= almost 3 ½ days of full-time assignment work) in order to achieve the same level of exam preparedness and assignment completion as under the allocation of time given above as an example. Given the limited total time available, it is likely that there would be insufficient actual time available for you to complete either the exam preparation or assignment work to a standard that you might otherwise be capable of. **Thus time spent on lecture review and doing associated reading, completion of weekly tutorial/practical exercises and note-taking are all very well worth activities.**

Also it should be noted that **attendance at timetabled classes is not only a requirement placed on you by a regulation of the university (see Section 23), but it is also very time-effective.** If you attend a lecture for example, then subsequent review of the lecture and reading associated with it will be much easier than attempting to understand the lecture notes/slides without having attended the lecture. It will probably take you more than 1 work hour to achieve the same level of understanding as someone who has attended the lecture. Thus non-attendance at classes is actually only increasing your total workload.

Section 15: Preparation for examinations and tests

Apart from ensuring that you allocate sufficient time for exam/test revision (see previous section), there are a number of other activities you would be well advised to do in preparation for the exam:

§ Attend any revision classes and take due note of any information and advice given.

§ Make sure you understand the format of the exam and conditions under which the exam is to be taken i.e. how many questions of various types you are expected to complete, exam length, any materials you are allowed/provided with or not allowed e.g. calculator or mathematics equation sheet, etc.

§ Find out when and where the exam is to be held and produce a revision timetable and stick to it.

§ Read through the lecture notes, tutorial/practical work and any model answers that might have been provided in order to make sure that,

  o you understand the content of the lectures, tutorials, practical work, etc. If you don't understand then you will need to do additional work with background reading and asking colleagues and members of staff for additional explanation.

  o make revision notes of your own which re-expresses the content of the module in your own words – these may be very summary if you understand the concepts covered very well. Remember the revision notes should cover the tutorial work as well as the lectures.

§ Review your revision notes regularly ideally until you no longer need to consult them i.e. you can run through the revision notes accurately without looking at them.

§ Do not become discouraged if you do not understand something the first time you look at it. It is very common that something will need to be reviewed several times before you understand it.

§ Try to explain some idea/concept to another person or even to yourself. Does it appear to make sense the way you have explained it? If it doesn't then you probably need to do some more work on your understanding.

§ Try and relate what has been covered to other things you already understand.

§ Obtain and work through any past papers if you can hold of them – it is best to do so only after you have done some revision.

§ Work through the tutorial exercises without looking at any model answers to see if you can solve them for yourself. If you can't then you need to extra work until you can.

§ Try and make up your own exam paper – think of possible questions that could be asked and try to produce a marking award (how many marks to be given for each point someone might correctly cover/explain in an answer). Then try and answer your questions. You can do this under exam conditions and then check your answers i.e. mark them for yourself. See how you do. Then revise further your weak points.

Section 16: Management of the award

To understand the award and to know where you fit in, you need to know how it is managed. Students are represented so that they may contribute to decisions that are made. Your input is just as vital as the academics and managers, indeed over the last few years changes have been made to the award, to the manner of presentation of a module, assessments etc. as a direct result of student opinion. At the beginning of each Academic Year the award leader will ask for volunteers to be Student Representatives these volunteers will then be elected by the students. Student Representatives are there to represent the views of the students in their year.

The day to day running of the award is the responsibility of the Level leaders, but there are other academics also involved. These are:

- § Module leaders
- § Industrial placement tutors
- § Industrial tutors
- § Personal Tutors
- § Project Manager
- § Project Supervisors

All modules have an individual module leader who is responsible for the delivery and assessment of the module. Any problems at module level should be referred to them. At the end of Level C, presentations from the industrial placement tutors will tell you how to complete your CV and how to apply for placements. They will arrange your interviews as appropriate and will help you look for a placement. An industrial tutor will be allocated to supervise you during the placement.

The project manager will implement project development policy and will co-ordinate the selection and supervision of Level 3 projects within your chosen Award.

External Examiners

You should be aware that all results are also monitored by External Examiners who are senior academics from other institutions. They are responsible for the continuing standards across all of the Awards both internally and externally, in other words they make sure you have been properly and fairly assessed, which is vitally important to the credence given to your final qualifications.

Section 17: Programme specific assessment matters

Programme specific regulations are regulations which are in addition to those specified in the University Undergraduate Modular Framework Regulations. This section should be read in conjunction with **Section 24: Teaching, learning and assessment**. They allow for award and Awards to have regulations that are specifically tailored for them.

MEng

The level M of the MEng is governed by the postgraduate academic award regulations. These may also be found at *http://www.staffs.ac.uk/current/regulations/academic/index.php* .

It is of note that these regulations differ from the Undergraduate Regulations in a number of significant ways. Of particular note is that the pass for a module is set at grade point 7 (50%) rather than grade point 4 (40%) for undergraduate modules. Also of note is that compensation can not be applied to grade points 0, 1, 2, or 3 i.e. only grade points 4, 5, or 6 are eligible for compensation. For a full description of the regulations see the web link above.

Minimum Threshold marks

In order to achieve a pass in a module, a minimum of 20% is required in each component of assessment (separate components being those identified in the weighting between assessments shown in the module descriptor). If less than 20% is achieved in a given component of assessment and an aggregate mark is achieved, over all assessments, of >= 40%, then the grade point given for the module is a 3. Where the aggregated mark is less than 40%, then the grade point given for the module is that normally associated with the given mark. Failure of a module due to failure to achieve >= 20% in each component of assessment, may still be subject to compensation and condonement.

Industrial placement

The responsibility for finding a suitable placement rests with the student. While the Faculty will support a student in finding a placement through its placement unit, it does not guarantee that a placement will be found for every student who wants one. This reflects the reality that placements involve a third party, the placement employer, who is under no obligation to offer a placement or take any specific students on as placement students. Ultimately such decisions reside with the employer and thus cannot be mandated by the University.

The industrial placement normally requires the completion of 48 weeks in relevant supervised work experience. Normally a student enrolled on a sandwich award must pass the sandwich year to progress to level H. However, in exceptional circumstances the completion of the industrial placement may be deferred until after the completion of level H. Where this occurs such students will still be required to pass an industrial placement before they can be awarded a sandwich degree.

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A student who fails the industrial placement period will only be allowed one further attempt. The referral attempt must normally occur within 18 months. Failure at the second attempt will mean that the student cannot further progress on a sandwich award. The student would have to transfer onto an appropriate non-sandwich full-time award in order to continue on the Computer Networks and Security award.

To be eligible for the award of an Honours degree with a sandwich a student must pass the industrial placement period.

Transfer between a sandwich award and a non-sandwich award

Students may opt to transfer from a non-sandwich award to an appropriate sandwich award at any time.

Students may transfer from a sandwich version of their award to a non-sandwich version at any time up until the end of week 4 of level I. However, after week 4 of level I, the transfer is only permitted if one or more of the following criteria are met,

1) a student is unable, for valid reasons e.g. extenuating circumstances, to undertake or complete an industrial placement;
2) a student, having attempted the industrial placement, has failed it;
3) a student has BOTH been unable to secure a placement 12 months after the start of level I i.e. by the end of the September following level I (for September entrants) or the start of January (for January entrants) AND has a portfolio of evidence, agreed with the Placements Unit, that shows that the student has made a bona fide attempt to obtain a placement.

Final year project

In order to qualify for the award of an Honours degree all 3 project modules must be passed (this includes passes by compensation and/or referral). A maximum of one project module may be compensated and normally compensation will only be applied if the project module to be compensated has a grade point 3. A grade point 1 or 0 will never be compensated.

If, at the first attempt one or more of the project modules are failed and have not been compensated (subject to the compensation regulation above), then upon successful completion of referrals in those modules, the maximum degree classification that can be awarded is limited to the base classification the student achieved as a result of their first attempt at level H, except where the overall score is less than 4, in which case a third class honours degree is specified as the maximum.

Note that referral does not refer to re-assessment that is being undertaken as if for the first time.

Progression from level H to level M

The MEng level is only available to students who are registered on a BEng(Hons) award. The award board will consider progression at the end of level H. Progression from level H to level M is subject to the provision that the student has met the criteria for the award of a BEng (Hons) degree with a level of performance at least equivalent to BEng(Hons) lower second

classification. However, a classification equivalent to at least an upper second would normally be expected.

If a student is eligible for the award of a BEng/BEng(Hons), but has not met the criteria for progression to level M, then the student will be awarded the BEng/BEng(Hons) as appropriate and will not be permitted to progress to level M.

Award of BEng upon failure of the MEng

A student having progressed to level M but failing to achieve 120 credits points at level M on completion of referral opportunities will be awarded the BEng with Honours at the level determined by the award board at the end of their level H studies.

Section 18: Criteria for admission to, and transfer within the award

Multiple points of entry

The Award adopts a flexible approach to the timing of entry to the Award. In general applicants may apply for admission to the Award at any level. They will need to meet any entry requirements (see various sections below for details). The Award permits applicants who have met the admissions requirements for entry to level I or level H of the award to commence their study at the start of the second teaching block as well as the first. At level C study would normally commence at the start of the first teaching block, however, study may commence at the start of the second teaching block provided that the applicant has been credited with Introduction to Software Development through APL/APEL.

Normal admission requirements

For entry to the programme, the standard requirement is 220-280 UCAS Tariff Points. We welcome applications from people with a wide variety of qualifications, skills and experience. Applications are individually assessed. A typical offer for an applicant with 3 A levels, a BTEC National Diploma or equivalent will be 280 points. Those with 2 A levels, a BTEC National Certificate or equivalent will be 220 points. For all applicants up to 40 points may come from level 3 key skills, AS qualifications. For applicants with qualifications not mentioned above please contact the FCET Student Recruitment Centre.

For more information on Staffordshire University's Undergraduate entry requirements please consult
http://www.staffs.ac.uk/courses/undergrad/requirements/index.php

Admission with Prior Credit

In line with the Award's commitment to credit transfer (CATS) and Accreditation of Prior Learning (APL), applicants may apply for admission to the Award at any entry point. Although a prior qualification may carry sufficient general credits for entry, the applicant must offer sufficient specific credits which are relevant to the Award. A programme of balancing studies, to match the needs of the student may be designed to enable the student to transfer to the appropriate Level and Award.

Part 2 is on the Faculty website

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