



# UNIVERSITY OF LINCOLN

## Programme Specification

Title:

### Games Computing

Final Award: **Master of Computing (MComp)**

With Exit Awards at:

**Certificate of Higher Education (CertHE)**

**Diploma of Higher Education (DipHE)**

**Bachelor of Science with Honours (BSc (Hons))**

**Master of Computing (MComp)**

To be delivered from: 1 Sep 2014

<b>Level</b>	<b>Date</b>
Level 1 or Certificate of Higher Education (CertHE)	2019-20
Level 2 or Diploma of Higher Education (DipHE)	2020-21
Level 3 or Bachelor of Science with Honours (BSc (Hons))	2021-22
Level 4 or Master of Computing (MComp)	2022-23

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## **1. Introduction**

This document describes one of the University of Lincoln's programmes using the protocols required by the UK National Qualifications Framework as defined in the publication *QAA guidelines for preparing programme specifications*.

This programme operates under the policy and regulatory frameworks of the University of Lincoln.

## 2. Basic Programme Data

<b>Final Award:</b>	Master of Computing (MComp)
<b>Programme Title:</b>	Games Computing
<b>Exit Awards and Titles</b>	Certificate of Higher Education (CertHE) Diploma of Higher Education (DipHE) Bachelor of Science with Honours (BSc (Hons)) Master of Computing (MComp)
<b>Subject(s)</b>	Computer Games Computing
<b>Mode(s) of delivery</b>	Full Time Part Time
<b>Is there a Placement or Exchange?</b>	Yes
<b>UCAS code</b>	G610
<b>Awarding Body</b>	University of Lincoln
<b>Campus(es)</b>	Lincoln Campus
<b>School(s)</b>	School of Computer Science
<b>Programme Leader</b>	Chris Headleand (cHeadleand)
<b>Relevant Subject Benchmark Statements</b>	
<b>Professional, Statutory or Regulatory Body Accreditation</b>	BCS the Chartered Institute for IT
<b>Programme Start Date</b>	2019-20

## 3. Programme Description

### 3.1 Overview

The programme is distinctive in providing a strong conceptual and methodological grounding in game design and development, as well as a contemporary approach to more general software development and computer science. Throughout the course, you are encouraged to recognise that software engineering is as important as creative design in the success of computer game products.

Game programming, mathematics, artificial intelligence and other specialist topics such as concept development and physics simulation are studied. In the first year of the degree, alongside core games modules students have the opportunity to study fundamental principles of software development providing the solid grounding in computer science that underpins their degree. In the second year, there is in-depth study expected in areas of games computing, such as games programming, concept development, artificial intelligence, and user interface design. In addition, you will have the opportunity to apply the skills you have learnt as a group in a simulated commercial setting. As well as completing a games development project in the third year, students can choose from a range of specialist optional modules, this is supported by core modules in computer graphics, and procedural content generation.

### 3.2 Aims and Objectives

MComp Games Computing is a four-year, prestige, integrated Masters degree giving substantial experience in practical design and development of a range of types of computer games software. The course aims to develop professional and transferable skills in the selection of deployment of a range of methods, techniques and practices in Games Computing. Graduates will be equipped for employment or further study in the computer games industry, or the wider computing industry with opportunities in programming, systems analysis, systems management, and the IT professions. The emphasis is on the development of skills and knowledge in the field of computer games development, alongside a deep and wide-ranging grounding in core computing principles, including current methods and developments. The programme builds upon and develops the study undertaken in the equivalent BSc (Hons) award. It includes an industrially-related project, some optional study modules at Masters level and a substantial final year project.

#### QAA Subject Benchmark Statement(s):

This programme responds to the United Kingdom QAA benchmark statements for the subject of Computing. Benchmarking analysis provides a detailed specification of the relationship between this programme's curriculum and the relevant QAA benchmark(s).

#### Internal Context

Programmes in the School of Computer Science can be taken as three year BSc (Hons) awards or four year BSc (Hons) awards that include an optional sandwich work placement. Programmes are also available as four year MComp (Master of Computing) awards or five year MComp awards if the optional sandwich placement is also taken. The School is the home for research centres concerned with Computer Vision, in Autonomous Systems, Machine Learning, HCI and Games Research. Study programmes have been structured to exploit this expertise and to ensure that wherever possible, teaching is informed by current sector-leading research. Opportunities for students to become familiar with and ultimately involved in research activity are actively promoted. The School is located in the College of Science and integrates with other Colleges, Schools and Departments through the provision of collaborative awards at undergraduate and postgraduate level. This integration is further consolidated through the College's committee structures, through Research seminar programmes

and through cross college staff and student development and other collaborative activity. This approach is central to our 'Student as Producer' ethos, which underpins many of our teaching and learning initiatives at the University of Lincoln.

External contexts:

BSc (Hons) Games Computing is part of an ongoing response to changes in the discipline of Games Computing and its emerging and volatile application contexts. The programme particularly seeks to acknowledge and formalise relationships between the maturing theory and practice of computing and information systems development. The College has been successful in engaging business to work with staff and student groups. Due to the School's international research portfolio the number of international, national and regional partnerships with commercial, academic, charitable and other institutions has seen huge growth. An example of this is the multi-million Euro project Pravda funded by EPSRC and Wellcome Foundation to develop new and better treatments for cancer. The College is also growing its relationship with industry through Knowledge Transfer Partnerships and through its relationship with Sparkhouse Studios.

### **3.3 Variations to Standard Regulations and Guidance**

Yes - see the Approved Variations to the University's Undergraduate Regulations:

<http://secretariat.blogs.lincoln.ac.uk/university-regulations/>

## 4. Programme Outcomes

Programme-level learning outcomes are identified below.

Refer to *Appendix I – Curriculum Map* for details of how outcomes are deployed across the programme.

### 4.1 Knowledge and Understanding

On successful completion of this programme a student will have knowledge and understanding of:

- 1 modelling and design of computer-based systems for the purposes of comprehension, communication, prediction and the understanding of trade-offs
- 3 the criteria, requirements, specifications and practical constraints appropriate to specific problems in computer systems, information systems, embedded systems and distributed systems, and plan strategies for their solution
- 5 the extent to which a computer-based system meets the criteria defined for its current use and future development
- 6 the theory, methods, tools and practices for the specification, design, implementation and evaluation of general computing based systems
- 7 the professional, legal, moral and ethical issues and considerations involved in the exploitation of computer technology
- 10 contemporary tools and techniques used in interface design
- 11 industry-standard methods in human-computer interaction that inform the development of interface design and enhanced user experience
- 13 mathematical techniques used in the design and development of software
- 14 tools and techniques used in the production of a games computing deliverable
- 15 abstracted models of systems structure, behaviour and purpose
- 16 the theoretical and practical capabilities of scalable non-relational and relational database systems
- 19 the architecture and functionality of game engines
- 20 the specification, design, implementation and evaluation of computer-based systems
- 21 evaluation mechanisms for problem solving strategies
- 22 abstracted models of systems structure, behaviour and purpose
- 23 industry-standard methods in human-computer interaction that inform the development of usable interfaces and enhance the user experience
- 27 the theoretical and practical capabilities of artificial intelligence
- 28 the architecture, design and underlying patterns of a game
- 29 a range techniques in quality assurance
- 30 the various operating systems and paradigms available for use in the field of computer science
- 40 deep knowledge and understanding within the specified domain of projects completed

and students following the Sandwich variant of the award will, in addition, have knowledge and understanding of:

99 organisational structures and processes in context

#### **4.2 Subject Specific Intellectual Skills**

On successful completion of this programme a student will be able to:

- 101 evaluate systems in terms of general quality attributes and possible trade-offs presented within the given problem
- 102 evaluate any risks inherent in the operation of computer-based systems with emphasis on ethical and privacy considerations
- 103 solve a range of different problems using appropriate academic and industry-centric strategies
- 104 engage appropriately in the production of a games computing deliverable
- 106 characterise systems implementation strategies in the context of contemporary business requirements
- 140 analyse, assess and integrate appropriate theoretical frameworks with industrial practice

#### **4.3 Subject Specific Practical Skills**

On successful completion of this programme a student will be able to:

- 201 design, implement and evaluate computer-based systems
- 202 deploy the tools used for the construction and documentation of computer-based applications
- 204 work as a member of a development team, recognising the different roles within a team and different ways of organising teams
- 205 select and apply tools and techniques appropriate to a range of service oriented architecture developments
- 206 apply models of systems structure, behaviour and purpose to organisational systems
- 207 select and apply standard tools and techniques in the development and evaluation of software systems and artefacts
- 208 implement scalable non-relational and relational databases that address the requirements of organisational information requirements
- 210 solve a range of different problems using appropriate strategies
- 211 formulate a project plan, and update it appropriately in the course of its execution
- 217 construct a portfolio of design documentation to illustrate a game design
- 218 utilise appropriate quality assurance techniques
- 240 adopt a research-based approach to key skills in the field of games computing

and students following the Sandwich variant of the award will, in addition, be able to:

- 220 adopt a professional approach in fulfilling work tasks



#### 4.4 Transferable Skills and Attributes

On successful completion of this programme a student will be able to:

- 301 research problem domains using appropriate methods and techniques
- 302 identify material from multiple published sources relevant to a chosen topic, and from it synthesise theories, principles or designs relevant to a practical, problem-solving project
- 303 deliver a presentation using appropriate professional standards with supporting documentation suitable for a wider audience
- 304 manage one's own learning and development including time management and organisational skills
- 305 evaluate the need for continuing professional development and lifelong learning
- 306 communicate succinctly to a range of audiences (orally or in writing) using rational and reasoned arguments
- 307 work effectively as a member of a team
- 310 meet the skill needs of contemporary industry with a wide range of development skills with emphasis on computer science
- 311 meet the skill needs of contemporary industry with a wide range of development skills with emphasis on games computing
- 340 conduct research appropriate to masters level and report on findings with suitable depth and perception

and students following the Sandwich variant of the award will, in addition, be able to:

- 320 adopt a professional approach in fulfilling work tasks

For details of each module contributing to the programme, please consult the module specification document.

## **5. Learning, Teaching and Assessment Strategies**

### **5.1. Learning and Teaching Strategy**

The teaching and learning strategy derives from the programme learning outcomes and is influenced by a school initiative to emphasize optionality and student choice in the context of an integrated suite of related programmes.

Knowledge and understanding are developed in a number of ways: student engagement and participation in scheduled activities such as lectures and workshops; following directed reading and undertaking wider reading and study; through primary and secondary research activity such as using the physical library or the stock of on-line journals and e-books.

Subject specific intellectual skills are developed in a number of ways: by engaging with the formative and summative assessment tasks; by peer review, self-appraisal and self-evaluation; being challenged to justify assumptions and recommendations made.

Subject specific practical skills are developed in a number of ways: by using software development tools and programming environments; using both standard and less-popular applications for generation of documents; developing research techniques to analyse, evaluate and justify solutions.

Transferable skills and attributes are developed in a number of ways: planning and executing activities; undertaking project work; managing time in routine and deadline situations; working as a member and as a leader of a team.

Each student is assigned a personal tutor at the start of their programme. Students will have regular meetings throughout the academic year with their tutor to discuss progress and to monitor performance and engagement and provide a forum for frank exchange and to ask questions and raise concerns. Meetings will often take place in small groups of students but will occasionally be on an individual basis to promote open and free discussion. Personal Tutors will encourage students to develop their transferable skills in particular communications and study skills. Throughout all levels of study students are presented with opportunities to engage in tutorial support, either physically or virtually to ensure appropriate transferable and subject specific skills are appropriately developed. Students continue to have access to their tutor on a scheduled basis throughout their programme.

All personal tutors monitor the engagement of their tutees both in terms of attendance and academic performance. Tutors will discuss engagement with their tutees both informally and at certain key points in the calendar, on a more formal basis of progress review. Module tutors all publish surgery hours for students taking their modules and undertake to be available for these times to deal with questions about the content of the material.

All modules host a site on the Virtual Learning environment where students can access information such as lecture slides, workshop tasks, hand-in dates for assignment work etc. Programme briefing documents, study and assessment materials for all modules are delivered via the VLE as part of a responsive, University managed, service.

In the early stages of the programme emphasis is placed on managed approaches to knowledge acquisition and the development of core understanding. The primary delivery vehicles at this stage are lectures. Plenary workshop activities provide an opportunity for review of material and practical application. These devices attempt to establish important conceptual frameworks; to instil an appropriate value set and to provide a map of the discipline and those aspects that will be key foci for further study. Workshops and practical exercises more usually support skill development curricula and learning materials are used extensively to facilitate individually paced skill acquisition and

development. The programme is largely common with other programmes, giving a broad basis of understanding, and the possibility of transfer to other related programmes.

As the study programme progresses project-based and student-led/tutor directed approaches are introduced to encourage the notion of learner independence and to promote application of developing competencies. The tendency at this stage is for more modules to challenge student assimilation, ability to apply and critique. Options are introduced, allowing students to tune the programme to their own interests and abilities, drawing upon the material available from other programmes in the School.

Learning in project based modules is typically negotiated between supervisor and student in an effort to establish scope and to specify assessment requirements. Opportunities for students to become familiar with and ultimately involved in research activity are actively promoted and supported by the University's "Student As Producer" initiative.

## **5.2. Assessment Strategy**

A range of assessment styles are deployed; the assessment mode for each module is chosen to appropriately respond to subject content and learning outcomes and also to acknowledge the maturity and sophistication of the candidate group. Throughout the programme, students are introduced to formative feedback as a strategy to improve performance, and develop reflective skills.

Examinations as tests of knowledge and understanding are deployed where appropriate. The curriculum also includes instances of multiple-choice, open book, closed book and practical/research-based time constrained assessment. Wherever an examination or a time-constrained test is scheduled a mock or sample test is always run to give students an indication of the style and level of the test being employed.

In-course assessment techniques are equally varied and are targeted at individuals and, where appropriate, group submissions. Coursework portfolios are widely used at Level 1 and in practical modules as a mechanism for managing breadth and complexity and as an instrument for providing ongoing feedback. In their final level students undertake a substantial project activity that affords the opportunity for significant practical and research focused activity and assessment.

Submissions of all coursework items take place by upload to the Virtual Learning Environment. Wherever appropriate, submissions are subject to plagiarism detection software: students are made aware of this and are provided with support and guidance concerning plagiarism and other academic offences. Students are provided with coursework marks via the VLE and feedback to students is provided through the same medium.

The Assessment Map gives a top-level indication of the scheduling and distribution of assessment modes within the programme. Details of module assessment strategy are included with each module specification.

## 6. Programme Structure

The total number of credit points required for the achievement of Certificate of Higher Education (CertHE) is 120.

The total number of credit points required for the achievement of Diploma of Higher Education (DipHE) is 240.

The total number of credit points required for the achievement of Bachelor of Science with Honours (BSc (Hons)) is 360.

The total number of credit points required for the achievement of Master of Computing (MComp) is 480.

### Level 1

<b>Title</b>	<b>Credit Rating</b>	<b>Core / Optional</b>
Maths for Computing 2019-20	15	Core
Algorithms and Complexity 2019-20	15	Core
Problem Solving 2019-20	15	Core
Game Design 2019-20	15	Core
Game Studies 2019-20	15	Core
Object-Oriented Programming 2019-20	30	Core
Programming Fundamentals 2019-20	15	Core

### Level 2

<b>Title</b>	<b>Credit Rating</b>	<b>Core / Optional</b>
Artificial Intelligence 2020-21	15	Core
Study Period Abroad: Computer Science 2020-21	0	Optional
Team Software Engineering 2020-21	30	Core
Advanced Programming 2020-21	15	Core
Scalable Database Systems 2020-21	15	Core
Concept Development 2020-21	15	Core
User Experience Design 2020-21	15	Core
Game Programming 2020-21	15	Core

### Level 3

<b>Title</b>	<b>Credit Rating</b>	<b>Core / Optional</b>
Physics Simulation 2021-22	15	Core
Autonomous Mobile Robotics 2021-22	15	Optional
Image Processing 2021-22	15	Optional
Cross-Platform Development 2021-22	15	Optional
Procedural Content Generation 2021-22	15	Core
Graphics 2021-22	15	Core
Project 2021-22	45	Core
Cyber Security 2021-22	15	Optional
Virtual and Augmented Reality 2021-22	15	Optional
Parallel Programming 2021-22	15	Optional
Machine Learning 2021-22	15	Optional
Big Data 2021-22	15	Optional

**Level 4**

<b>Title</b>	<b>Credit Rating</b>	<b>Core / Optional</b>
Cross-Platform Development (M) 2022-23	15	Optional
Game Design Methods and Approaches 2022-23	15	Optional
Advanced Graphics 2022-23	15	Optional
MComp Research Project 2022-23	60	Core
Autonomous Mobile Robotics (M) 2022-23	15	Optional
Image Processing (M) 2022-23	15	Optional
Cyber Security (M) 2022-23	15	Optional
Virtual and Augmented Reality (M) 2022-23	15	Optional
Parallel Programming (M) 2022-23	15	Optional
Machine Learning (M) 2022-23	15	Optional
Big Data (M) 2022-23	15	Optional

**Masters**

<b>Title</b>	<b>Credit Rating</b>	<b>Core / Optional</b>
Advanced Artificial Intelligence 2022-23	15	Optional
Advanced Programming 2022-23	15	Optional
Computer Vision 2022-23	15	Optional
Research Methods (MSc Computer Science) 2022-23	15	Core
Mobile and Connected Devices 2022-23	15	Optional

## Appendix I - Curriculum Map

This table indicates which modules assume responsibility for delivering and ordering particular programme learning outcomes.

Key:  Delivered and Assessed     Delivered     Assessed

### Level 1

	PO1	PO3	PO5	PO6	PO7	PO10	PO11	PO13	PO14	PO15	PO16	PO19
Algorithms and Complexity 2019-20	<input checked="" type="checkbox"/>							<input checked="" type="checkbox"/>				
Game Design 2019-20	<input checked="" type="checkbox"/>								<input checked="" type="checkbox"/>			
Game Studies 2019-20												
Maths for Computing 2019-20								<input checked="" type="checkbox"/>				
Object-Oriented Programming 2019-20	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Problem Solving 2019-20												
Programming Fundamentals 2019-20	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

	PO20	PO21	PO22	PO23	PO27	PO28	PO29	PO30	PO40	PO99	PO10 1	PO10 2
Algorithms and Complexity 2019-20	<input checked="" type="checkbox"/>							<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
Game Design 2019-20						<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>	
Game Studies 2019-20						<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20	<input checked="" type="checkbox"/>											
Problem Solving 2019-20		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									
Programming Fundamentals 2019-20	<input checked="" type="checkbox"/>											

	PO10 3	PO10 4	PO10 6	PO14 0	PO20 1	PO20 2	PO20 4	PO20 5	PO20 6	PO20 7	PO20 8	PO21 0
Algorithms and Complexity 2019-20									<input checked="" type="checkbox"/>			
Game Design 2019-20		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>						
Game Studies 2019-20												

Maths for Computing 2019-20													
Object-Oriented Programming 2019-20													
Problem Solving 2019-20	✓						✓						✓
Programming Fundamentals 2019-20		✓											
	PO21 1	PO21 7	PO21 8	PO22 0	PO24 0	PO30 1	PO30 2	PO30 3	PO30 4	PO30 5	PO30 6	PO30 7	
Algorithms and Complexity 2019-20											✓		
Game Design 2019-20													
Game Studies 2019-20			✓										
Maths for Computing 2019-20						✓							
Object-Oriented Programming 2019-20													
Problem Solving 2019-20								✓		✓			
Programming Fundamentals 2019-20				✓			✓						
									PO31 0	PO31 1	PO32 0	PO34 0	
Algorithms and Complexity 2019-20													
Game Design 2019-20													
Game Studies 2019-20													
Maths for Computing 2019-20													
Object-Oriented Programming 2019-20									✓				
Problem Solving 2019-20													
Programming Fundamentals 2019-20									✓				

## Level 2

	PO1	PO3	PO5	PO6	PO7	PO10	PO11	PO13	PO14	PO15	PO16	PO19
Advanced Programming 2020-21	✓	✓		✓				✓	✓			
Artificial Intelligence 2020-21												
Concept Development 2020-21	✓					✓						

Game Programming 2020-21		✓	✓									
Scalable Database Systems 2020-21			✓							✓	✓	
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21	✓	✓	✓	✓	✓	✓				✓		
User Experience Design 2020-21	✓	✓	✓			✓	✓					

	PO20	PO21	PO22	PO23	PO27	PO28	PO29	PO30	PO40	PO99	PO10 1	PO10 2
Advanced Programming 2020-21	✓										✓	
Artificial Intelligence 2020-21	✓				✓						✓	
Concept Development 2020-21						✓					✓	
Game Programming 2020-21	✓					✓	✓				✓	
Scalable Database Systems 2020-21												
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21	✓									✓	✓	✓
User Experience Design 2020-21			✓	✓							✓	

	PO10 3	PO10 4	PO10 6	PO14 0	PO20 1	PO20 2	PO20 4	PO20 5	PO20 6	PO20 7	PO20 8	PO21 0
Advanced Programming 2020-21		✓			✓	✓			✓			
Artificial Intelligence 2020-21					✓	✓						
Concept Development 2020-21						✓				✓		
Game Programming 2020-21		✓				✓				✓		
Scalable Database Systems 2020-21					✓				✓		✓	
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21	✓	✓			✓		✓					
User Experience Design 2020-21			✓		✓	✓		✓		✓		

	PO21 1	PO21 7	PO21 8	PO22 0	PO24 0	PO30 1	PO30 2	PO30 3	PO30 4	PO30 5	PO30 6	PO30 7



Advanced Programming 2020-21												
Artificial Intelligence 2020-21												
Concept Development 2020-21		✓										
Game Programming 2020-21			✓									
Scalable Database Systems 2020-21												
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21			✓	✓		✓		✓	✓	✓	✓	✓
User Experience Design 2020-21							✓		✓		✓	

	PO31 0	PO31 1	PO32 0	PO34 0
Advanced Programming 2020-21	✓			
Artificial Intelligence 2020-21				
Concept Development 2020-21				
Game Programming 2020-21		✓		
Scalable Database Systems 2020-21				
Study Period Abroad: Computer Science 2020-21			✓	
Team Software Engineering 2020-21	✓			
User Experience Design 2020-21				

### Level 3

	PO1	PO3	PO5	PO6	PO7	PO10	PO11	PO13	PO14	PO15	PO16	PO19
Autonomous Mobile Robotics 2021-22		✓	✓									
Big Data 2021-22	✓			✓					✓			
Cross-Platform Development 2021-22		✓									✓	
Cyber Security 2021-22			✓		✓							
Graphics 2021-22			✓									✓
Image Processing 2021-22								✓				
Machine Learning 2021-22				✓						✓	✓	

Parallel Programming 2021-22	✓	✓							✓	✓		
Physics Simulation 2021-22									✓	✓		
Procedural Content Generation 2021-22			✓									
Project 2021-22		✓	✓	✓	✓					✓		
Virtual and Augmented Reality 2021-22			✓	✓						✓		

	PO20	PO21	PO22	PO23	PO27	PO28	PO29	PO30	PO40	PO99	PO10 1	PO10 2
Autonomous Mobile Robotics 2021-22												
Big Data 2021-22											✓	✓
Cross-Platform Development 2021-22												
Cyber Security 2021-22			✓									✓
Graphics 2021-22											✓	
Image Processing 2021-22										✓		
Machine Learning 2021-22			✓		✓			✓			✓	
Parallel Programming 2021-22	✓		✓								✓	✓
Physics Simulation 2021-22						✓					✓	
Procedural Content Generation 2021-22	✓					✓						
Project 2021-22	✓										✓	✓
Virtual and Augmented Reality 2021-22											✓	

	PO10 3	PO10 4	PO10 6	PO14 0	PO20 1	PO20 2	PO20 4	PO20 5	PO20 6	PO20 7	PO20 8	PO21 0
Autonomous Mobile Robotics 2021-22												
Big Data 2021-22					✓	✓	✓					
Cross-Platform Development 2021-22					✓	✓		✓			✓	
Cyber Security 2021-22										✓		
Graphics 2021-22												
Image Processing 2021-22					✓							
Machine Learning 2021-22	✓		✓		✓	✓						✓
Parallel Programming 2021-22	✓	✓			✓	✓		✓		✓		
Physics Simulation 2021-22						✓						
Procedural Content Generation 2021-22	✓				✓	✓				✓		

Project 2021-22		✓			✓	✓				✓		
Virtual and Augmented Reality 2021-22	✓	✓			✓	✓				✓		
	PO21 1	PO21 7	PO21 8	PO22 0	PO24 0	PO30 1	PO30 2	PO30 3	PO30 4	PO30 5	PO30 6	PO30 7
Autonomous Mobile Robotics 2021-22												
Big Data 2021-22								✓				
Cross-Platform Development 2021-22							✓					
Cyber Security 2021-22												
Graphics 2021-22		✓										
Image Processing 2021-22												
Machine Learning 2021-22												
Parallel Programming 2021-22						✓	✓					
Physics Simulation 2021-22			✓									
Procedural Content Generation 2021-22		✓					✓					
Project 2021-22	✓	✓		✓		✓	✓		✓		✓	
Virtual and Augmented Reality 2021-22												
									PO31 0	PO31 1	PO32 0	PO34 0
Autonomous Mobile Robotics 2021-22												
Big Data 2021-22												
Cross-Platform Development 2021-22												
Cyber Security 2021-22												
Graphics 2021-22										✓		
Image Processing 2021-22												
Machine Learning 2021-22												
Parallel Programming 2021-22												
Physics Simulation 2021-22												
Procedural Content Generation 2021-22										✓		
Project 2021-22									✓		✓	
Virtual and Augmented Reality 2021-22												

## Level 4

	PO1	PO3	PO5	PO6	PO7	PO10	PO11	PO13	PO14	PO15	PO16	PO19
Advanced Graphics 2022-23	✓							✓	✓			
Autonomous Mobile Robotics (M) 2022-23		✓	✓									
Big Data (M) 2022-23												
Cross-Platform Development (M) 2022-23												
Cyber Security (M) 2022-23												
Game Design Methods and Approaches 2022-23	✓								✓			
Image Processing (M) 2022-23												
Machine Learning (M) 2022-23												
MComp Research Project 2022-23		✓										
Parallel Programming (M) 2022-23												
Virtual and Augmented Reality (M) 2022-23												

	PO20	PO21	PO22	PO23	PO27	PO28	PO29	PO30	PO40	PO99	PO10 1	PO10 2
Advanced Graphics 2022-23												
Autonomous Mobile Robotics (M) 2022-23												
Big Data (M) 2022-23												
Cross-Platform Development (M) 2022-23												
Cyber Security (M) 2022-23												
Game Design Methods and Approaches 2022-23												
Image Processing (M) 2022-23										✓		
Machine Learning (M) 2022-23												
MComp Research Project 2022-23									✓			
Parallel Programming (M) 2022-23												
Virtual and Augmented Reality (M) 2022-23												

PO10	PO10	PO10	PO14	PO20	PO20	PO20	PO20	PO20	PO20	PO20	PO20	PO21
------	------	------	------	------	------	------	------	------	------	------	------	------

	3	4	6	0	1	2	4	5	6	7	8	0
Advanced Graphics 2022-23										✓		
Autonomous Mobile Robotics (M) 2022-23												
Big Data (M) 2022-23												
Cross-Platform Development (M) 2022-23												
Cyber Security (M) 2022-23												
Game Design Methods and Approaches 2022-23										✓		
Image Processing (M) 2022-23												
Machine Learning (M) 2022-23												
MComp Research Project 2022-23				✓								
Parallel Programming (M) 2022-23												
Virtual and Augmented Reality (M) 2022-23												

	PO21 1	PO21 7	PO21 8	PO22 0	PO24 0	PO30 1	PO30 2	PO30 3	PO30 4	PO30 5	PO30 6	PO30 7
Advanced Graphics 2022-23					✓							
Autonomous Mobile Robotics (M) 2022-23					✓							
Big Data (M) 2022-23												
Cross-Platform Development (M) 2022-23												
Cyber Security (M) 2022-23												
Game Design Methods and Approaches 2022-23					✓							
Image Processing (M) 2022-23					✓							
Machine Learning (M) 2022-23												
MComp Research Project 2022-23												
Parallel Programming (M) 2022-23												
Virtual and Augmented Reality (M) 2022-23												

	PO31 0	PO31 1	PO32 0	PO34 0
Advanced Graphics 2022-23				✓
Autonomous Mobile Robotics (M) 2022-23				✓

Big Data (M) 2022-23				
Cross-Platform Development (M) 2022-23				
Cyber Security (M) 2022-23				
Game Design Methods and Approaches 2022-23				✓
Image Processing (M) 2022-23				✓
Machine Learning (M) 2022-23				
MComp Research Project 2022-23			✓	✓
Parallel Programming (M) 2022-23				
Virtual and Augmented Reality (M) 2022-23				

## Masters

	PO1	PO3	PO5	PO6	PO7	PO10	PO11	PO13	PO14	PO15	PO16	PO19
Advanced Artificial Intelligence 2022-23	✓											
Advanced Programming 2022-23	✓											
Computer Vision 2022-23		✓										
Mobile and Connected Devices 2022-23		✓										
Research Methods (MSc Computer Science) 2022-23					✓							

	PO20	PO21	PO22	PO23	PO27	PO28	PO29	PO30	PO40	PO99	PO10 1	PO10 2
Advanced Artificial Intelligence 2022-23												✓
Advanced Programming 2022-23												✓
Computer Vision 2022-23												✓
Mobile and Connected Devices 2022-23												
Research Methods (MSc Computer Science) 2022-23									✓			

	PO10 3	PO10 4	PO10 6	PO14 0	PO20 1	PO20 2	PO20 4	PO20 5	PO20 6	PO20 7	PO20 8	PO21 0

Advanced Artificial Intelligence 2022-23													
Advanced Programming 2022-23													
Computer Vision 2022-23													
Mobile and Connected Devices 2022-23													
Research Methods (MSc Computer Science) 2022-23													

	PO21 1	PO21 7	PO21 8	PO22 0	PO24 0	PO30 1	PO30 2	PO30 3	PO30 4	PO30 5	PO30 6	PO30 7
Advanced Artificial Intelligence 2022-23					✓							
Advanced Programming 2022-23					✓							
Computer Vision 2022-23					✓							
Mobile and Connected Devices 2022-23					✓							
Research Methods (MSc Computer Science) 2022-23												

	PO31 0	PO31 1	PO32 0	PO34 0
Advanced Artificial Intelligence 2022-23				✓
Advanced Programming 2022-23				✓
Computer Vision 2022-23				✓
Mobile and Connected Devices 2022-23				✓
Research Methods (MSc Computer Science) 2022-23				✓

## Appendix II - Assessment Map

This table indicates the spread of assessment activity across the programme. Percentages indicate assessment weighting.

### Level 1

	01	02	03	04	05	06	07	08	09	10	11	12
Algorithms and Complexity 2019-20												
Game Design 2019-20												
Game Studies 2019-20										40		
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20												
Problem Solving 2019-20												
Programming Fundamentals 2019-20							50					
	13	14	15	16	17	18	19	20	21	22	23	24
Algorithms and Complexity 2019-20												
Game Design 2019-20											60	
Game Studies 2019-20												
Maths for Computing 2019-20							40					
Object-Oriented Programming 2019-20							20				10	
Problem Solving 2019-20												
Programming Fundamentals 2019-20	50											
	25	26	27	28	29	30	31	32	33	34	35	36
Algorithms and Complexity 2019-20	60						40					
Game Design 2019-20						40						
Game Studies 2019-20												
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20						70						
Problem Solving 2019-20	100											
Programming Fundamentals 2019-20												



	37	38	39	40	41	42	43	44	45	46	47	48
Algorithms and Complexity 2019-20												
Game Design 2019-20												
Game Studies 2019-20												
Maths for Computing 2019-20												
Object-Oriented Programming 2019-20												
Problem Solving 2019-20												
Programming Fundamentals 2019-20												

	49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Algorithms and Complexity 2019-20						
Game Design 2019-20						
Game Studies 2019-20					60	
Maths for Computing 2019-20						60
Object-Oriented Programming 2019-20						
Problem Solving 2019-20						
Programming Fundamentals 2019-20						

## Level 2

	01	02	03	04	05	06	07	08	09	10	11	12
Advanced Programming 2020-21												
Artificial Intelligence 2020-21												
Concept Development 2020-21												
Game Programming 2020-21												
Scalable Database Systems 2020-21								50				

Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21								20				
User Experience Design 2020-21												
	13	14	15	16	17	18	19	20	21	22	23	24
Advanced Programming 2020-21	100											
Artificial Intelligence 2020-21												
Concept Development 2020-21	100											
Game Programming 2020-21												
Scalable Database Systems 2020-21	50											
Study Period Abroad: Computer Science 2020-21												
Team Software Engineering 2020-21												
User Experience Design 2020-21												
	25	26	27	28	29	30	31	32	33	34	35	36
Advanced Programming 2020-21												
Artificial Intelligence 2020-21			40									
Concept Development 2020-21												
Game Programming 2020-21						100						
Scalable Database Systems 2020-21												
Study Period Abroad: Computer Science 2020-21								100				
Team Software Engineering 2020-21		20				60						
User Experience Design 2020-21						50						
	37	38	39	40	41	42	43	44	45	46	47	48
Advanced Programming 2020-21												
Artificial Intelligence 2020-21												
Concept Development 2020-21												
Game Programming 2020-21												
Scalable Database Systems 2020-21												

Study Period Abroad: Computer Science 2020-21													
Team Software Engineering 2020-21													
User Experience Design 2020-21													
								49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Advanced Programming 2020-21													
Artificial Intelligence 2020-21													60
Concept Development 2020-21													
Game Programming 2020-21													
Scalable Database Systems 2020-21													
Study Period Abroad: Computer Science 2020-21													
Team Software Engineering 2020-21													
User Experience Design 2020-21													50

### Level 3

	01	02	03	04	05	06	07	08	09	10	11	12
Autonomous Mobile Robotics 2021-22												
Big Data 2021-22										50		
Cross-Platform Development 2021-22												
Cyber Security 2021-22												
Graphics 2021-22						50						50
Image Processing 2021-22												
Machine Learning 2021-22										50		
Parallel Programming 2021-22												
Physics Simulation 2021-22												

Procedural Content Generation 2021-22													
Project 2021-22													
Virtual and Augmented Reality 2021-22													
	13	14	15	16	17	18	19	20	21	22	23	24	
Autonomous Mobile Robotics 2021-22													
Big Data 2021-22	50												
Cross-Platform Development 2021-22													
Cyber Security 2021-22								60					
Graphics 2021-22													
Image Processing 2021-22	100												
Machine Learning 2021-22	50												
Parallel Programming 2021-22											30		
Physics Simulation 2021-22													
Procedural Content Generation 2021-22													
Project 2021-22	20												
Virtual and Augmented Reality 2021-22	100												
	25	26	27	28	29	30	31	32	33	34	35	36	
Autonomous Mobile Robotics 2021-22		50											
Big Data 2021-22													
Cross-Platform Development 2021-22										100			
Cyber Security 2021-22		40											
Graphics 2021-22													
Image Processing 2021-22													
Machine Learning 2021-22													
Parallel Programming 2021-22													
Physics Simulation 2021-22		40											
Procedural Content Generation 2021-22		100											
Project 2021-22					60		20						
Virtual and Augmented Reality 2021-22													
	37	38	39	40	41	42	43	44	45	46	47	48	



**Level 4**

	01	02	03	04	05	06	07	08	09	10	11	12
Advanced Graphics 2022-23									60			
Autonomous Mobile Robotics (M) 2022-23												
Big Data (M) 2022-23										40		
Cross-Platform Development (M) 2022-23												
Cyber Security (M) 2022-23												
Game Design Methods and Approaches 2022-23												
Image Processing (M) 2022-23							40					
Machine Learning (M) 2022-23										40		
MComp Research Project 2022-23							15					
Parallel Programming (M) 2022-23												
Virtual and Augmented Reality (M) 2022-23												
	13	14	15	16	17	18	19	20	21	22	23	24
Advanced Graphics 2022-23				40								
Autonomous Mobile Robotics (M) 2022-23												
Big Data (M) 2022-23	60											
Cross-Platform Development (M) 2022-23												
Cyber Security (M) 2022-23								50				
Game Design Methods and Approaches 2022-23												
Image Processing (M) 2022-23	20											
Machine Learning (M) 2022-23	60											
MComp Research Project 2022-23												
Parallel Programming (M) 2022-23											20	
Virtual and Augmented Reality (M) 2022-23	100											
	25	26	27	28	29	30	31	32	33	34	35	36
Advanced Graphics 2022-23												

Autonomous Mobile Robotics (M) 2022-23		40						20					
Big Data (M) 2022-23													
Cross-Platform Development (M) 2022-23				100									
Cyber Security (M) 2022-23		50											
Game Design Methods and Approaches 2022-23													
Image Processing (M) 2022-23													
Machine Learning (M) 2022-23													
MComp Research Project 2022-23							85						
Parallel Programming (M) 2022-23							20						
Virtual and Augmented Reality (M) 2022-23													
	37	38	39	40	41	42	43	44	45	46	47	48	
Advanced Graphics 2022-23													
Autonomous Mobile Robotics (M) 2022-23													
Big Data (M) 2022-23													
Cross-Platform Development (M) 2022-23													
Cyber Security (M) 2022-23													
Game Design Methods and Approaches 2022-23													
Image Processing (M) 2022-23													
Machine Learning (M) 2022-23													
MComp Research Project 2022-23													
Parallel Programming (M) 2022-23													
Virtual and Augmented Reality (M) 2022-23													
							49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)	
Advanced Graphics 2022-23													
Autonomous Mobile Robotics (M) 2022-23													40

Big Data (M) 2022-23												
Cross-Platform Development (M) 2022-23												
Cyber Security (M) 2022-23												
Game Design Methods and Approaches 2022-23										100		
Image Processing (M) 2022-23											40	
Machine Learning (M) 2022-23												
MComp Research Project 2022-23												
Parallel Programming (M) 2022-23											60	
Virtual and Augmented Reality (M) 2022-23												

## Masters

	01	02	03	04	05	06	07	08	09	10	11	12
Advanced Artificial Intelligence 2022-23												
Advanced Programming 2022-23												
Computer Vision 2022-23												
Mobile and Connected Devices 2022-23												
Research Methods (MSc Computer Science) 2022-23												100

	13	14	15	16	17	18	19	20	21	22	23	24
Advanced Artificial Intelligence 2022-23	50			50								
Advanced Programming 2022-23				100								
Computer Vision 2022-23												
Mobile and Connected Devices 2022-23												
Research Methods (MSc Computer Science) 2022-23												

	25	26	27	28	29	30	31	32	33	34	35	36
Advanced Artificial Intelligence 2022-23												
Advanced Programming 2022-23												



Computer Vision 2022-23									100				
Mobile and Connected Devices 2022-23									100				
Research Methods (MSc Computer Science) 2022-23													
	37	38	39	40	41	42	43	44	45	46	47	48	
Advanced Artificial Intelligence 2022-23													
Advanced Programming 2022-23													
Computer Vision 2022-23													
Mobile and Connected Devices 2022-23													
Research Methods (MSc Computer Science) 2022-23													
								49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Advanced Artificial Intelligence 2022-23													
Advanced Programming 2022-23													
Computer Vision 2022-23													
Mobile and Connected Devices 2022-23													
Research Methods (MSc Computer Science) 2022-23													

## Appendix III - Benchmark Analysis

This table maps programme learning outcomes to relevant QAA subject benchmark statements or PSRB guidelines.

### Knowledge and Understanding

	Comp01	Comp02	Comp03	Comp04	Comp05	Comp06	Comp07	Comp08	Comp09
PO1	✓		✓			✓	✓		✓
PO3	✓		✓				✓		✓
PO5	✓		✓				✓		✓
PO6									
PO7	✓		✓		✓		✓		✓
PO10									
PO11									
PO13	✓								
PO14		✓	✓					✓	✓
PO15									
PO16									
PO19	✓						✓		
PO20	✓		✓			✓	✓		✓
PO21									
PO22									
PO23									
PO27									
PO28	✓	✓							
PO29	✓		✓					✓	✓
PO30									
PO40				✓					
PO99				✓	✓				
				Comp10	Comp11	Comp12	Comp13	Comp14	Comp15
PO1						✓			

PO3									
PO5									
PO6									
PO7				✓					
PO10									
PO11									
PO13		✓							
PO14									
PO15									
PO16									
PO19									
PO20						✓			
PO21									
PO22									
PO23									
PO27									
PO28									
PO29									
PO30									
PO40							✓	✓	✓
PO99									

### Subject Specific Intellectual Skills

	Comp01	Comp02	Comp03	Comp04	Comp05	Comp06	Comp07	Comp08	Comp09
PO101			✓						✓
PO102			✓						✓
PO103									
PO104		✓	✓					✓	✓
PO106									
PO140									

	Comp10	Comp11	Comp12	Comp13	Comp14	Comp15
PO101						
PO102						
PO103						
PO104						
PO106						
PO140				✓	✓	✓

### Subject Specific Practical Skills

	Comp01	Comp02	Comp03	Comp04	Comp05	Comp06	Comp07	Comp08	Comp09
PO201	✓	✓							
PO202		✓	✓					✓	✓
PO204				✓	✓				
PO205									
PO206									
PO207		✓				✓		✓	
PO208									
PO210									
PO211									
PO217		✓		✓		✓	✓		
PO218		✓		✓		✓	✓		
PO220				✓	✓				
PO240									

	Comp10	Comp11	Comp12	Comp13	Comp14	Comp15
PO201			✓			
PO202						
PO204	✓	✓				
PO205						

PO206								
PO207					✓			
PO208								
PO210								
PO211								
PO217								
PO218								
PO220				✓				✓
PO240							✓	✓

### Transferable Skills and Attributes

	Comp01	Comp02	Comp03	Comp04	Comp05	Comp06	Comp07	Comp08	Comp09
PO301				✓					
PO302				✓					
PO303				✓					
PO304				✓					
PO305				✓					
PO306				✓					
PO307				✓	✓				
PO310									
PO311					✓				
PO320				✓	✓				
PO340									

	Comp10	Comp11	Comp12	Comp13	Comp14	Comp15
PO301	✓					
PO302	✓					
PO303	✓					
PO304	✓					
PO305	✓	✓				

PO306	✓					
PO307	✓	✓				
PO310						
PO311	✓		✓			
PO320	✓	✓				
PO340				✓	✓	✓

## **Appendix IV: Benchmark Benchmark Statement(s)**

**Comp01** - *Demonstrate a requisite understanding of the main body of knowledge for their programme of study*

**Comp02** - *Understand and apply essential concepts, principles and practice of the subject in the context of well-defined scenarios, showing judgement in the selection and application of tools and techniques.*

**Comp03** - *Produce work involving problem identification, the analysis, the design or development of a system with appropriate documentation, recognising the important relationships between these...*

**Comp04** - *Demonstrate transferrable skills and an ability to work under guidance and as a team member.*

**Comp05** - *Identify appropriate practices within a professional, legal and ethical framework and understand the need for continuing professional development.*

**Comp06** - *Discuss applications based upon the body of knowledge.*

**Comp07** - *Demonstrate a sound understanding of the main areas of the body of knowledge within their programme of study, with an ability to exercise critical judgement across a range of issues.*

**Comp08** - *Critically analyse and apply a range of concepts, principles and practice of the subject in an appropriate manner in the context of loosely defined scenarios, showing effective judgement in the selection and use of tools and techniques.*

**Comp09** - *Produce work involving problem identification, the analysis, the design or the development of a system, with accompanying documentation, recognising the important relationships between these...*

**Comp10** - *Demonstrate transferable skills with an ability to show organised work as an individual and as a team member and with minimum guidance.*

**Comp11** - *Apply appropriate practices within a professional, legal and ethical framework and identify mechanisms for continuing professional development and lifelong learning.*

**Comp12** - *Explain a wide range of applications based upon the body of knowledge.*

**Comp13** - *Creative and innovative in their application of the principles covered in the*

**Comp14** - *Able to contribute significantly to the analysis, design or the development of systems which are complex, and fit for purpose, recognising the important relationships between these.*

**Comp15** - *Able to exercise critical evaluation and review of both their own work and the work of others.*