HERIOT WATT UNIVERSITY

School of Mathematical & Computer Sciences

Postgraduate Programme Handbook

MSc/PGD Artificial Intelligence
MSc/PGD Artificial Intelligence (2 Years)
MSc/PGD Artificial Intelligence with Speech and Multimodal Interaction
MSc/PGD Business Information Management
MSc/PGD Computer Systems Management
MSc/PGD Computing (2 Years)
MSc/PGD Data Science
MSc/PGD Data Science (2 Years)
MSc/PGD Human Robot Interaction
MSc/PGD Human Robot Interaction (2 Years)
MSc/PGD Information Technology (Business)
MSc/PGD Information Technology (Software Systems)
MSc/PGD Network Security
MSc/PGD Software Engineering

Edinburgh Campus

2018-2019

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PART A: SCHOOL INFORMATION

Summary of Key Information

Introduction
This handbook contains information on the programme structure, notes, description and the courses offered on the MSc degrees offered by the Department of Computer Science, School of Mathematical and Computer Sciences.

School Student Website
Lots of information regarding MACS programmes and courses can be found at:
https://www.macs.hw.ac.uk/students/

University Student Website
https://www.hw.ac.uk/students/new-students.htm
https://www.hw.ac.uk/students/index.htm

Student Portal
You can access the University Student Portal at: http://portal.hw.ac.uk/

Virtual Learning Environment (VLE)
Most courses have on-line material available at the University's Virtual Learning Environment (VISION) which can be found at: https://vision.hw.ac.uk/

Student Self Service
This is where you can update your address and where you will get your on-line results - https://myhwu.hw.ac.uk/

Key Personnel

Head of School	Professor Beatrice Pelloni	B.Pelloni@hw.ac.uk
Head of Computer Science	Professor Albert Burger	A.G.Burger@hw.ac.uk
Director, Postgraduate Study	Dr Hamish Taylor	H.Taylor@hw.ac.uk
Programme Director, Artificial Intelligence	Dr Ron Petrick	R.Petrick@hw.ac.uk
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Programme Director, Network Security	Dr Manuel Maarek	M.Maarek@hw.ac.uk

Programme Director, Software Engineering	Dr Manuel Maarek	M.Maarek@hw.ac.uk
Administrator	Ms Rodi Amiridou	R.Amiridou@hw.ac.uk
Special Needs Advisor	Dr Tessa Berg	T.Berg@hw.ac.uk

***Any Student with a special need should contact Tessa Berg in the first instance for information and advice.

First point of contact for enquiries should be the School Office – Earl Mountbatten (EM) Room 1.25, macs-schooloffice@hw.ac.uk

Full staff details can be found at: https://www.hw.ac.uk/schools/mathematical-computer-sciences/staff-profiles.htm

Non Departmental Contacts

Lecturer	Email (@hw.ac.uk)	Room	Telephone (0131 451)	Course
School of Management & Languages (C-coded courses)				
Robert Graham	R.Graham	MB 1.37	3848	C11OH
Amos Haniff	A.Haniff	MB 1.39	3847	C11SP
John Saunders	J.W.Saunders	MB G.39	3857	C11CS
Shahreza Mohammadi	R.Mohammadi	EM 1.77	3289	C11PA

MSc Calendar – 2018/19

2018/19 dates	Activity
3 - 7 September 2018	Welcome Week
10 September – 30 November 2018	Semester 1 teaching
3 – 14 December 2018	Semester 1 exams
17 December 2018 – 4 January 2019	Semester 1 break
7 January – 29 March 2019	Semester 2 teaching
1 – 22 April 2019 (Easter: 21 April)	Semester 2 break
23 April – 3 May 2019	Semester 2 exams
6 May – 14 August 2019	Dissertation work
15 August 2019	Dissertation Submission
18 – 21 June 2019 (Edinburgh Campus)	Graduations
1 – 9 August 2019	Resits
14 – 15 November 2019	Graduations

Further information can be found at:
https://www.hw.ac.uk/students/index.htm and http://www.hw.ac.uk/registry/

Information about our Information Services can be found at: https://www.hw.ac.uk/services/is/guides/getting-started.htm

All students registered for the programme are expected to have read and to be familiar with the contents of this Handbook.

Disclaimer: Every effort has been made to ensure the contents of this handbook are accurate. Unforeseen circumstances may necessitate changes to the procedures, curricula described.

MSc PROGRAMMES

ARTIFICIAL INTELLIGENCE

Programme Director: Dr Ron Petrick

The aim of this MSc programme is to impart the skills and understanding required to develop intelligent software applications especially those involving evolutionary computation and learning. Students will acquire critical skills and knowledge in Data Mining and Machine Learning, Biologically Inspired Computation, as well as applicable skills concerning applications of Artificial Intelligence to the World Wide Web and (optionally) computer games.

Therefore the aims are to enable the students to:

- Develop detailed knowledge and critical understanding of the main areas of artificial intelligence (including theories, principles and concepts).
- Develop and use a significant range of principal and specialist skills, techniques and practices in the domain.
- Critically review existing practice and develop original and creative solutions to problems within the domain.
- Communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.
- Plan and execute a significant project of research, investigation or development in a specialist area within artificial intelligence, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the principal theories, principles and concepts relating to the domain of artificial intelligence.
- Extensive, detailed and critical understanding of at least one specialist area within the domain of artificial intelligence.
- Understanding and use of a significant range of the principal skills, techniques and practices in artificial intelligence, and a range of specialised skills, research and investigation techniques, and practices informed by leading-edge research within the domain.
- A broad knowledge of the main areas of artificial intelligence, including terminology, conventions, underpinning theory, techniques and practices.
- Application-based knowledge and skills relating to the broad range of activities within the domain, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.
- Extensive and detailed knowledge of theories and algorithms relating to artificial intelligence, with specialist applicative skills appropriate to the subdisciplines.
- Extensive and detailed knowledge and understanding of technologies relating to artificial intelligence, and their application, including the ability to critically analyse and review such technologies to support original and creative application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of artificial intelligence, including machine learning, web intelligence and biologically inspired models of computation.
- Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of artificial intelligence, and in the design of projects and experimental models.
- Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain.

Scholarship, Enquiry and Research

- Research skills and the capability of critical analysis, through review and analysis of current research literature.
- An understanding of research ethics, and how to appropriately build on the work of others.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current legal, social, ethical and professional issues within the discipline.
- Make informed judgements with incomplete or inconsistent data, or where there are no professional or ethical codes or practices for guidance.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.

Communication, Numeracy and ICT

- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.
- Develop and demonstrate critical knowledge and skills in the planning and usage of software tools and numerical techniques to develop, present and communicate information on projects and processes.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 3 mandatory courses and students must choose 5 courses from options (see below). In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21BC	Biologically inspired Computation	M	15
F21DL	Data Mining & Machine Learning	M	15
F21GA	3D Graphics and Animation	O	15
F21RO	Intelligent Robotics	O	15
F21SF	Software Engineering Foundations	O	15
F29AI	Artificial intelligence & Intelligent Agents	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21AD	Advanced Interaction Design	O	15
F21AS	Advanced Software Engineering	O	15
F21BD	Big Data Management	O	15
F21CA	Conversational Agents and Spoken Language Processing	O	15
F21GP	Computer Games Programming	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

ARTIFICIAL INTELLIGENCE (2 Years)

Programme Director: Dr Ron Petrick

The aim of this 2 year MSc AI programme is to impart the skills and understanding required to develop intelligent software applications especially those involving evolutionary computation and learning. Students will acquire critical skills and knowledge in Data Mining and Machine Learning, Biologically Inspired Computation, as well as applicable skills concerning applications of Artificial Intelligence to the world wide web and (optionally) computer games.
Therefore, the aims are to enable the students to:

- Develop detailed knowledge and critical understanding of the main areas of artificial intelligence (including theories, principles and concepts).
- Develop and use a significant range of principal and specialist skills, techniques and practices in the domain.
- Critically review existing practice and develop original and creative solutions to problems within the domain.
- Communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.
- Plan and execute a significant project of research, investigation or development in a specialist area within artificial intelligence, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the principal theories, principles and concepts relating to the domain of artificial intelligence.
- Extensive, detailed and critical understanding of at least one specialist area within the domain of artificial intelligence.
- Understanding and use of a significant range of the principal skills, techniques and practices in artificial intelligence, and a range of specialised skills, research and investigation techniques, and practices informed by leading-edge research within the domain.
- A broad knowledge of the main areas of artificial intelligence, including terminology, conventions, underpinning theory, techniques and practices.
- Application-based knowledge and skills relating to the broad range of activities within the domain, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.
- Extensive and detailed knowledge of theories and algorithms relating to artificial intelligence, with specialist applicative skills appropriate to the subdisciplines.
- Extensive and detailed knowledge and understanding of technologies relating to artificial intelligence, and their application, including the ability to critically analyse and review such technologies to support original and creative application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of artificial intelligence, including machine learning, web intelligence and biologically inspired models of computation.
- Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of artificial intelligence, and in the design of projects and experimental models.
- Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain.

Scholarship, Enquiry and Research

- Research skills, and the capability of critical analysis, through review and analysis of current research literature.
- An understanding of research ethics, and how to appropriately build on the work of others.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current legal, social, ethical and professional issues within the discipline.
- Make informed judgements with incomplete or inconsistent data, or where there are no professional or ethical codes or practices for guidance.

Autonomy, Accountability and Working with Others

Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.

Communication, Numeracy and ICT

- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.
- Develop and demonstrate critical knowledge and skills in the planning and usage of software tools and numerical techniques to develop, present and communicate information on projects and processes.

In Stage 1 students study on 8 taught courses (4 mandatory and 4 optional) worth 15 credits each.
In Stage 2 students study on 8 taught courses (3 mandatory and 5 optional) worth 15 credits each followed by an MSc dissertation project worth 60 credits.

Course Code	Title	Mandatory/ Optional	Credits
Stage 1, Semester 1			
F21SF	Software Engineering Foundations	M	15
F29AI	Artificial Intelligence & Intelligent Agents	M	15
F21DF	Databases and Information Systems	O	15
F21SA	Statistical Modelling and Analysis	O	15
F29KM	Knowledge Management	O	15
C69RP	Research Preparation in English (1)	O	15
Stage 1, Semester 2			
F20AD	Advanced Interaction Design	M	15
F21AS	Advanced Software Engineering	M	15
F21SM	Software Engineering Master Class	O	15
F29OC	Operating Systems & Concurrency	O	15
F29SS	Sociotechnical and Soft Systems	O	15
C69RQ	Research Preparation in English (2)	O	15

Stage 2, Semester 1			
F21BC	Biologically Inspired Computation	M	15
F21DL	Data Mining & Machine Learning	M	15
F21DV	Data Visualisation and Analytics	O	15
F21GA	3D Graphics and Animation	O	15
F21RO	Intelligent Robotics	O	15
F21SC	Industrial Programming	O	15
Stage 2, Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21BD	Big Data Management	O	15
F21CA	Conversational Agents and Spoken Language Processing	O	15
F2DP	Distributed and Parallel Technologies	O	15
F21GP	Computer Games Programming	O	15
Stage 2, Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

Progression from Stage 1 to Stage 2:

- Progression to stage 2 depends on passing 8 courses at grade D or better with an 8 course average of 50% plus getting a grade C or better on F29AI and F21SF, as well as C69RP and C69RQ for entrants with an IELTS below 6.5
- Students may retake the assessment of up to a maximum of 3 courses at the next opportunity, subject to payment of the appropriate fees to the University, and may be required to do so to obtain the necessary credits for progression or exit. Students may only resit courses for which their assessment grade is E or F (or a grade D but only if a grade C is required in order to progress to the next stage).
- Students may exit at the end of this stage with a Graduate Diploma in Computer Science if they get credits for 8 courses at grade E or better with an 8 course average of 50%. They may exit with a Graduate Certificate in Computer Science after at least 1 semester of study if they get credits for 4 courses at grade E or better with a 4 course average of 40%.
- Students not meeting either the requirements for progression or for a Graduate Diploma or Graduate Certificate will not be eligible for any award.

ARTIFICIAL INTELLIGENCE WITH SPEECH AND MULTIMODAL INTERACTION

Programme Director: Dr Ron Petrick

The aim of this MSc programme is to import the understanding and skills to develop intelligent software applications, such as those involving evolutionary computation and learning, but with a specialist emphasis on developing spoken and multimodal interfaces. Students will acquire detailed understanding and skills in mainstream artificial intelligence research areas, while also learning the techniques and skills needed to develop conversational agents and other kinds of interactive multimodal interfaces. The specialist emphasis will expose students to methods from various disciplines, such as multi-modal system engineering, data-driven machine learning techniques, experimental design, natural language processing and social interaction.

In more detail, the programme aims to impart to students:

- Detailed knowledge and critical understanding of the main areas of artificial intelligence (including theories, principles and concepts).
- Significant range of principal and specialist skills, techniques and practices in the AI domain.
- Specialist knowledge of AI techniques as they apply to developing interactive multimodal and spoken interfaces.
- Ability to critically review existing practice and develop original and creative solutions to problems within the AI and spoken multimodal interface domain.
- Ability to communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.
- Ability to plan and execute a significant project of research, investigation or development in a specialist area within artificial intelligence, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the main theories, principles and concepts relating to the domain of artificial intelligence including terminology, conventions, standards and methodologies.
- Understanding and use of a significant range of the main skills, techniques and practices in intelligent software engineering, and a range of specialised skills, research and investigation techniques, and practices in speech and multimodal interaction informed by current practices within the AI and HCI domains.
- Broad and deep knowledge of the AI areas of data mining, machine learning, search and optimization, intelligent agents, knowledge representation and inference, planning, as well as application-based knowledge and skills relating to speech and multimodal interaction, and specialist knowledge and skills in applications relating to a number of specialist areas such as automation, biologically inspired computation, conversational agents, data visualization and analytics, robotics, spoken language processing and virtual reality.

Scholarship, Enquiry and Research

- Extensive, detailed and critical understanding of at least one specialist area within the domain of AI application development obtained through researching the background to a substantial and challenging AI engineering project that incorporates a multimodal spoken interface by personal scholarship, design and development of a detailed AI solution.
- Detailed knowledge and understanding of intelligent software engineering relating to spoken and multimodal interface application developments as well as the practical skills in how to exploit them in support of original and creative AI application development.

- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of AI application development including automation, conversational agents, robotics, spoken language processing, data mining and data visualization.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current issues within AI application development, and make informed judgements about them in the light of relevant professional standards.
- Demonstrate an awareness of professional and research issues in the AI discipline, and an ability to critique current techniques and practice.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
- Develop and utilise advanced problem-solving skills and techniques in the shared development of original and creative solutions to general and specialist AI engineering issues.
- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Communication, Numeracy and ICT

- Develop and demonstrate the ability to communicate and present the main issues involved in AI application development to a literate audience with appropriate use of modern presentational tools and aids.
- Demonstrate appropriate use of methods of calculation and estimation involved in planning AI engineering solutions and solving speech and multimodal interface design of such AI applications.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 4 mandatory courses and students must choose 4 courses from options (see below).

In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21DL	Data Mining & Machine Learning	M	15
F21SA	Statistical Modelling and Analysis	M	15
F21BC	Biologically Inspired Computation	O	15
F21DV	Data Visualisation and Analytics	O	15
F21GA	3D Graphics and Animation	O	15
F21SC	Industrial Programming	O	15
F29AI	Artificial Intelligence & Intelligent Agents	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21CA	Conversational Agents and Spoken Language Processing	M	15
F21AD	Advanced Interaction Design	O	15
F21BD	Big Data Management	O	15
F2DP	Distributed and Parallel Technologies	O	15
F21GP	Computer Games Programming	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

BUSINESS INFORMATION MANAGEMENT

Programme Director: Dr Hamish Taylor

The aim of this programme is to impart skills and understanding in information management and IT with a focus on business. It covers the organisation and development of business, information systems and IT. It also addresses management and design issues for them. The programme studies IT but it does not require students to design program or write software.

- Detailed knowledge and critical understanding of the information management and IT techniques needed to address modern business problems.
- Significant range of principal and specialist skills, techniques and practices in applying IT, information systems and data management techniques to business and e-commerce application areas.
- Ability to critically review existing practice and develop original and creative solutions to managing information digitally in application development problems.
- Experience of executing a significant project, investigation or development in the area of applying IT and information management techniques to modern business processes that demonstrates advanced skills and a critical understanding of the technologies required.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the main theories, principles and concepts relating to the domain of digital information management including terminology, conventions, standards and methodologies.
- Understanding and use of a significant range of the main skills, techniques and practices in information application development, and a range of specialised skills, research and investigation techniques, and practices informed by current practices within this domain.
- Broad knowledge of the main areas of information system, databases, business management, application-based knowledge and skills relating to the broad range of handling information in business processes, and specialist knowledge and skills in applications relating to a number of specialist areas such as business organisation, e-commerce, information processing and IT project management.

Scholarship, Enquiry and Research

- Extensive, detailed and critical understanding of at least one specialist area within the domain of business information management application development obtained through researching the background to a substantial and challenging project by personal scholarship and conducting a detailed empirical investigation into business information issues at stake.
- Detailed knowledge and understanding of data sources relating to business information management application developments as well the practical skills in how to exploit them in support of original and creative application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of digital information management application development including business strategies, digital marketing, e-commerce and IT project management.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current issues within business information management application development, and make informed judgements about them in the light of relevant professional standards.
- Demonstrate an awareness of professional and research issues in the discipline, and an ability to critique current techniques and practice.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
- Develop and utilise advanced problem-solving skills and techniques in the shared development of original and creative solutions to general and specialist business information management issues.
- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Communication, Numeracy and ICT

- Develop and demonstrate the ability to communicate and present the main issues involved in business information management application development to a literate audience with appropriate use of modern presentational tools and aids.
- Demonstrate appropriate use of methods of calculation and estimation involved in planning digital and information systems solutions and solving information management applications of business processes.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 4 mandatory courses and students must choose 4 courses from options (see below).

In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21DF	Databases and Information Systems	M	15
F21IF	Information Systems Methodologies	M	15
F21IM	Information Technology Master Class	O	15
F21SA	Statistical Modelling and Analysis	O	15
C11CS	Competitive Strategy	O	15
C11OH	Organisational Behaviour/Human Resource Management	O	15
Semester 2			
F21DE	Digital and Knowledge Economy	M	15
F21RP	Research Methods and Project Planning	M	15
F21AD	Advanced Interaction Design	O	15
F21BD	Big Data Management	O	15
F21EC	E-Commerce Technology	O	15
C11PA	Project Management	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

COMPUTER SYSTEMS MANAGEMENT

Programme Director: Dr Alasdair Gray

The aim of this MSc programme is to impart the skills and understanding required to enable students to manage complex computer systems as part of the support services of an organisation. This will include selection, installation, maintenance and support of a wide range of technologies, and an understanding of currently recommended methodologies.

In more detail, the programme aims to enable students to:

- Develop detailed knowledge and critical understanding of the main technologies and methodologies pertaining to computer services management.
- Develop and use a significant range of principal and specialist skills, techniques and practices in the domain, including systems programming and scripting.
- Critically review existing practice and develop original and creative solutions to problems within the domain.
- Communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.
- Plan and execute a significant project of research, investigation or development in a specialist area, demonstrating advanced skills and a critical understanding of the technologies required in computer systems management.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the principal theories, principles and concepts relating to the domain of computer services management.
- Extensive, detailed and critical understanding of at least one specialist area within the domain of computer services management.
- Understanding and use of a significant range of the principal skills, techniques and practices in computer services management, and a range of specialised skills, research and investigation techniques, and practices informed by current practices within the domain.
- A broad knowledge of the main areas of computer services management, including terminology, conventions, underpinning theory, techniques and practices.
- Application-based knowledge and skills relating to the broad range of activities within the domain, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.
- Extensive and detailed knowledge of theories and algorithms relating to computer services management, with specialist applicative skills appropriate to the subdisciplines.
- Extensive and detailed knowledge and understanding of technologies relating to computer services management, and their application, including the ability to critically analyse and review such technologies to support original and creative application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of computer services management, including systems programming, technologies such as C# and .NET, methodologies such as ITIL.

Scholarship, Enquiry and Research

- Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of computer services management, and in the design of projects and experimental models.
- An understanding of research ethics, and how to appropriately build on the work of others.
- Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current legal, social, ethical and professional issues within the discipline.
- Make informed judgements with incomplete or inconsistent data, or where there are no professional or ethical codes or practices for guidance.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.

Communication, Numeracy and ICT

- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.
- Develop and demonstrate critical knowledge and skills in the planning and usage of software tools and numerical techniques to develop, present and communicate information on projects and processes.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 4 mandatory courses and students must choose 4 courses from options (see below).

In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21CN	Computer Network Security	M	15
F2IDF	Databases and Information Systems	M	15
F21IF	Information Systems Methodologies	O	15
F21SC	Industrial Programming	O	15
F21SF	Software Engineering Foundations	O	15
F29DC	Data Communications and Networking	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
C11PA	Project Management	M	15
F21AN	Advanced Network Security	O	15
F21AS	Advanced Software Engineering	O	15
F21BD	Big Data Management	O	15
F21NA	Network Applications	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

COMPUTING (2 Years)

Programme Director: Dr Hamish Taylor

The principal aims of the 2 year MSc Computing programme are to turn successful graduates with an aptitude for programming into competent software engineers with a wide range of expertise in developing, enhancing and maintaining computing solutions to contemporary IT problems to professional practitioners' standards.

The main aims are:

Stage 1

- Enhance existing skills in code development through imparting detailed and extensive skills and experience in an object-oriented programming language in widespread professional use.
- Impart extensive knowledge and understanding of good practice, methodologies, standards, techniques and tools in software engineering.
- Cultivate extensive knowledge, critical understanding and a good range of practical skills in a few key topics in Computing.
- Develop English language skills contextualized through research preparation in Computing to a level appropriate for postgraduate taught study in stage 2.
- Provide tutorial and discussion opportunities of a style and at a level appropriate to prepare them for postgraduate taught study.
- Enable students to communicate and work effectively with peers and academic staff, demonstrating appropriate levels of autonomy, initiative and responsibility.

Stage 2

- Impart detailed knowledge and critical understanding in core areas of Computer Science including theories, principles and concepts.
- Inculcate a significant range of principal and specialist skills, techniques and practices in the Computing domain.
- Cultivate specialist knowledge of computing techniques as they apply to developing interactive, networked or secure applications.
- Instil the ability to critically review existing practice and develop original and creative solutions to problems requiring Computer Science solutions.
- Develop the ability to plan and execute a significant project of research, investigation or development in a specialist area within Computer Science, demonstrating extensive, detailed and critical understanding of that specialism.

The learning outcomes of the programme are:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the main theories, principles and concepts relating to the domain of computing and IT systems including terminology, conventions, standards and methodologies.
- Understanding and use of a significant range of the main skills, techniques and practices in software engineering and IT systems management, and a range of specialised skills, research and investigation techniques, and practices informed by current practices within the computing domain.
- Broad and deep knowledge of the main areas of software analysis, design, deployment, maintenance, management, trouble shooting, validation and verification.

Scholarship, Enquiry & Research

- Extensive, detailed and critical understanding of at least one specialist area in Computing obtained through researching the background to a substantial and challenging software engineering project by personal scholarship, design and development of a detailed software

systems solution that incorporates significant proportions of analysis, design, implementation and evaluation.

- Detailed knowledge and understanding of management and planning of software application development as well the practical skills in how to exploit them in support of original and creative computing system development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of software application development.

Autonomy, Accountability & Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
- Develop and utilise advanced problem-solving skills and techniques in the shared development of original and creative solutions to general and specialist computing and IT management issues.
- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Industrial, Commercial & Professional Practice

- Demonstrate critical awareness of current issues within computing application development, and make informed judgements about them in the light of relevant professional standards.
- Demonstrate an awareness of professional and research issues in the computing discipline, and an ability to critique current techniques and practice.

Communication, Numeracy and ICT

- Develop and demonstrate the ability to communicate and present the main issues involved in software application development to a literate audience with appropriate use of modern presentational tools and aids.
- Demonstrate appropriate use of methods of calculation and estimation involved in planning computing systems solutions and solving their IT management implications.

In Stage 1 students study on 8 taught courses (4 mandatory and 4 optional) worth 15 credits each.
In Stage 2 students study on 8 taught courses (4 mandatory and 4 optional) worth 15 credits each followed by an MSc dissertation project worth 60 credits.

Course Code	Title	Mandatory/ Optional	Credits
Stage 1, Semester 1			
F21SF	Software Engineering Foundations	M	15
C69RP	Research Preparation in English (1)	M	15
F21DF	Databases and Information Systems	O	15
F21IM	Information Technology Master Class	O	15
F29AI	Artificial Intelligence & Intelligent Agents	O	15
F29DC	Data Communications and Networking	O	15
Stage 1, Semester 2			
F21AS	Advanced Software Engineering	M	15
C69RQ	Research Preparation in English (2)	M	15
F20AD*	Advanced Interaction Design	O	15
F20NA	Network Applications	O	15
F29OC	Operating Systems & Concurrency	O	15
Stage 2, Semester 1			
F21CN	Computer Network Security	M	15
F21SC	Industrial Programming	M	15
F21BC	Biologically Inspired Computation	O	15
F21GA	3D Graphics and Animation	O	15
F21RO	Intelligent Robotics	O	15
Stage 2, Semester 2			
F21RP	Research Methods and Project Planning	M	15
C11PA	Project Management	M	15
F21AD*	Advanced Interaction Design	O	15
F21AN	Advanced Network Security	O	15
F21BD	Big Data Management	O	15
F21GP	Computer Games Programming	O	15
Stage 2, Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

* - Students who take F20AD in Stage 1 cannot take F21AD in Stage 2.

Progression from Stage 1 to Stage 2:

- Progression to stage 2 depends on passing 8 courses at grade D or better with an 8 course average of 50% plus getting a grade C or better on C69RP, C69RQ and F21SF.
- Students may retake the assessment of up to a maximum of 3 courses at the next opportunity, subject to payment of the appropriate fees to the University, and may be required to do so to obtain the necessary credits for progression or exit. Students may only resit courses for which their assessment grade is E or F (or a grade D if a C is required for progression to the next stage).
- Students may exit at the end of this stage with a Graduate Diploma in Computer Science if they get credits for 8 courses at grade E or better with an 8 course average of 40%. They may exit with a Graduate Certificate in Computer Science after at least 1 semester of study if they get credits for 4 courses at grade E or better with a 4 course average of 40%.
- Students not meeting either the requirements for progression or for a Graduate Diploma or Graduate Certificate will not be eligible for any award.

DATA SCIENCE

Programme Director: Dr Alasdair Gray

The aim of this MSc programme is to give good graduates with academic knowledge of databases and programming, the academic expertise they need to apply state of the art data analysis and visualization techniques to modern academic, business and government information processing problems. Particular issues of interest include data visualization, data mining, big data management and high performance information processing.

In more detail, the programme aims to impart to students:

- Detailed knowledge and critical understanding of the big data management and visualization techniques needed to analyse modern academic, business and government information sources.
- Significant range of principal and specialist skills, techniques and practices in applying IT, information systems and big data management techniques to large scale, complex and heterogeneous information analysis problems.
- Ability to critically review existing practice and develop original and creative solutions to managing challenging amounts and diversities of digital information for scientific, administrative and competitive commercial applications.
- Experience of executing a significant project, investigation or development in the area of applying IT and big data management techniques to modern information analytic processes that demonstrates advanced skills and a critical understanding of the technologies required.

In common with the other programmes in our postgraduate computer science discipline, the expected learning outcomes are as detailed below:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the main theories, principles and concepts relating to the domain of digital information management including terminology, conventions, standards and methodologies.
- Understanding and use of a significant range of the main skills, techniques and practices in big data processing, and a range of specialised skills, research and investigation techniques, and practices informed by current practices within the data science domain.
- Broad and deep knowledge of the main areas of information systems, databases, machine learning, data visualization, application-based knowledge and skills relating to the broad range of handling information processes, and specialist knowledge and skills in applications relating to a number of specialist areas such as business analytics, data mining, data visualization, data warehousing and high performance data processing.

Scholarship, Enquiry & Research

- Extensive, detailed and critical understanding of at least one specialist area within the domain of big data management application development obtained through researching the background to a substantial and challenging data analytics project by personal scholarship, design and development of a detailed information systems solution that incorporates significant proportions of software development or configuration to address the analysis issues at stake.
- Detailed knowledge and understanding of data sources relating to big information management application developments as well the practical skills in how to exploit them in support of original and creative data science application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of digital information management application development including data analysis, data mining, parallel data processing, data visualization and data warehousing.

Autonomy, Accountability & Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
- Develop and utilise advanced problem-solving skills and techniques in the shared development of original and creative solutions to general and specialist data science analysis and management issues.
- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Industrial, Commercial & Professional Practice

- Demonstrate critical awareness of current issues within big data management application development, and make informed judgements about them in the light of relevant professional standards.
- Demonstrate an awareness of professional and research issues in the data science discipline, and an ability to critique current techniques and practice.

Communication, Numeracy and ICT

- Develop and demonstrate the ability to communicate and present the main issues involved in data science application development to a literate audience with appropriate use of modern presentational tools and aids.
- Demonstrate appropriate use of methods of calculation and estimation involved in planning digital and information systems solutions and solving information management applications of big data processing.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 4 mandatory courses and students must choose 4 courses from options (see below).

In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21DL	Data Mining & Machine Learning	M	15
F21SA	Statistical Modelling and Analysis	M	15
F21BC	Biologically Inspired Computation	O	15
F21CN	Computer Network Security	O	15
F21DV	Data Visualisation and Analytics	O	15
F21SC	Industrial Programming	O	15
F21SF	Software Engineering Foundations	O	15
Semester 2			
F21BD	Big Data Management	M	15
F21RP	Research Methods and Project Planning	M	15
F21AS	Advanced Software Engineering	O	15
F21DE	Digital and Knowledge Economy	O	15
F21DP	Distributed and Parallel Technologies	O	15
F21NA	Network Applications	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

DATA SCIENCE (2 Years)

Programme Director: Dr Alasdair Gray

The programme aims to provide intensive and high-quality preparatory graduate (Stage 1) and postgraduate (Stage 2) education in Data Science. In stage 1 the degree will equip the graduate with academic and practical knowledge of databases and programming, and then in stage 2 the academic expertise they need to apply state of the art data analysis and processing techniques to modern academic, business and government information processing problems. Particular issues of interest include data visualization, data mining, big data management and high-performance information processing.

The whole two-year programme will be taught by a variety of traditional and innovative means, making use of applied topical material relevant to research and industry. This will create a supply of robustly prepared postgraduates with skills relevant to research and industrial applications of Data Science, in the UK and internationally.

The principal aims of the programme are to:

Stage 1

- Provide intensive and high-quality education in a wide range of subjects in computer programming and data management, as well as to related data structures and algorithms. The student is free to choose optional courses where they feel the need for further training, such as data communications and networks, operating systems, information systems, and research skills. These options will depend on the background of the student.
- Develop detailed knowledge and understanding in these key areas;
- Cultivate skills and enable students to develop original and creative solutions to problems in these key areas;
- Provide a challenging period of study which enables students to test themselves against standards requiring intensive work and strong commitment in a demanding environment to prepare them for postgraduate taught study;
- Enable students to develop detailed knowledge and critical understanding, and acquire a range of new skills, in central areas of Data Science;
- Provide tutorial and discussion opportunities of a style and at a level appropriate to prepare them for postgraduate taught study;
- Enable students to communicate and work effectively with peers and academic staff, demonstrating appropriate levels of autonomy, initiative and responsibility.

Stage 2 Students will acquire

- Detailed knowledge and critical understanding of the machine learning, big data management, and statistical analysis techniques needed to analyse modern academic, business and government information sources.
- Significant range of principal and specialist skills, techniques and practices in applying IT, information systems and big data management techniques to large scale, complex and heterogeneous information analysis problems.
- Ability to critically review existing practice and develop original and creative solutions to managing challenging amounts and diversities of digital information for scientific, administrative and competitive commercial applications.
- Experience of executing a significant project, investigation or development in the area of applying IT and big data management techniques to modern information analytic processes that demonstrates advanced skills and a critical understanding of the technologies required.

On completion of the programme, students will be able to demonstrate:

Understanding, Knowledge and Cognitive Skills

Stage 1

- Extensive and detailed knowledge, and critical understanding, of central areas of advanced undergraduate computing, including computer programming and software engineering, data management, AI and intelligent agents, and web-based applications.
- Extensive and detailed knowledge of the principles of Research Preparation: exploring their research community, adopting a critical perspective, establishing a rationale for doing their research, management and communication skills as part of a research project;
- The acquisition of a range of new skills required in data science such as interaction design, operating systems, and knowledge management. These options will depend on the background of the student.
- Awareness and understanding of current issues in computing, through teaching informed by current developments in industry, government policy and in computing research;
- Extensive knowledge and critical understanding of many of the principal theories and concepts of contemporary computing.
- Expertise in applying many of the principal skills, methods and techniques of computing used in research and industry.

Stage 2

- Critical understanding of the main theories, principles and concepts relating to the domain of digital information management including terminology, conventions, standards and methodologies.
- Understanding and use of a significant range of the main skills, techniques and practices in big data processing, and a range of specialised skills, research and investigation techniques, and practices informed by current practices within the data science domain.
- Broad and deep knowledge of the main areas of information systems, databases, machine learning, statistical analysis, data visualization, application-based knowledge and skills relating to the broad range of handling information processes, and specialist knowledge and skills in applications relating to a number of specialist areas such as business analytics, data mining, data visualization, data warehousing and high-performance data processing.
- The ability to manage, research, assimilate knowledge in, critically assess, analyse, write and complete a high quality lengthy dissertation on a contemporary problem in research level Data Science.

Scholarship, Enquiry and Research (Research-Informed Learning)

On completion of the programme, students will be able to:

- Extensive, detailed and critical understanding of at least one specialist area within the domain of big data management application development obtained through researching the background to a substantial and challenging data analytics project by personal scholarship, design and development of a detailed information systems solution that incorporates significant proportions of software development or configuration to address the analysis issues at stake.
- Detailed knowledge and understanding of data sources relating to big information management application developments as well the practical skills in how to exploit them in support of original and creative data science application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of digital information management application development including data analysis, data mining, parallel data processing, data visualization and data warehousing.
- Demonstrate that they have developed problem solving skills;
- Identify, analyse and solve problems, and discuss issues, at a professional level critically review existing practices and move on to research or professional careers with confidence.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current issues within big data management application development, and make informed judgements about them in the light of relevant professional standards.
- Demonstrate an awareness of professional and research issues in the data science discipline, and an ability to critique current techniques and practice.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
- Develop and utilise advanced problem-solving skills and techniques in the shared development of original and creative solutions to general and specialist data science analysis and management issues.
- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Communication, Numeracy & ICT

- Develop and demonstrate the ability to communicate and present the main issues involved in data science application development to a literate audience with appropriate use of modern presentational tools and aids.
- Demonstrate appropriate use of methods of calculation and estimation involved in planning digital and information systems solutions and solving information management applications of big data processing.

In Stage 1 students study on 8 taught courses (5 mandatory and 3 optional) worth 15 credits each.
In Stage 2 students study on 8 taught courses (4 mandatory and 4 optional) worth 15 credits each followed by an MSc dissertation project worth 60 credits.

Course Code	Title	Mandatory/ Optional	Credits
Stage 1, Semester 1			
F21SF	Software Engineering Foundations	M	15
F21DF	Databases and Information Systems	M	15
F29AI	Artificial Intelligence & Intelligent Agents	M	15
F29DC	Data Communications and Networking	O	15
F29KM	Knowledge Management	O	15
C69RP	Research Preparation in English (1)	O	15
Stage 1, Semester 2			
F20NA	Network Applications	M	15
F21AS	Advanced Software Engineering	M	15
F20AD	Advanced Interaction Design	O	15
F29OC	Operating Systems & Concurrency	O	15
F29SS	Sociotechnical and Soft Systems	O	15
C69RQ	Research Preparation in English (2)	O	15

Stage2, Semester 1			
F21DL	Data Mining & Machine Learning	M	15
F21SA	Statistical Modelling and Analysis	M	15
F21BC	Biologically Inspired Computation	O	15
F21CN	Computer Network Security	O	15
F21DV	Data Visualisation and Analytics	O	15
F21SC	Industrial Programming	O	15
Stage2, Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21BD	Big Data Management	M	15
F21CA	Conversational Agents and Spoken Language Processing	O	15
F21DE	Digital and Knowledge Economy	O	15
F2DP	Distributed and Parallel Technologies	O	15
Stage 2, Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

Progression from Stage 1 to Stage 2:

- Progression to stage 2 depends on passing 8 courses at grade D or better with an 8 course average of 50% plus getting a grade C or better on F21DF, F21SF and F29AI.
- Students may retake the assessment of up to a maximum of 3 courses at the next opportunity, subject to payment of the appropriate fees to the University, and may be required to do so to obtain the necessary credits for progression or exit. Students may only resit courses for which their assessment grade is E or F (or a grade D but only if a grade C is required to progress to the next stage).
- Students may exit at the end of this stage with a Graduate Diploma in Computer Science if they get credits for 8 courses at grade E or better with an 8 course average of 40%. They may exit with a Graduate Certificate in Computer Science after at least 1 semester of study if they get credits for 4 courses at grade E or better with a 4 course average of 40%.
- Students not meeting either the requirements for progression or for a Graduate Diploma or Graduate Certificate will not be eligible for any award.

HUMAN ROBOT INTERACTION

Programme Director: Dr Katrin Lohan

The principal aim of the MSc Human Robot Interaction programme is to equip postgraduates with skills and expertise in designing, developing, deploying and maintaining robots that are capable of communicating with and dependably working alongside human beings.

The objectives of this MSc programme are to develop:

- Critical understanding of the main theories, principles and concepts relating to the domain of human robot interaction including terminology, conventions, standards and methodologies.
- Understanding and use of a significant range of the main skills, techniques and practices in robotic software engineering, and a range of specialised skills, research and investigation techniques, and practices in human robot interaction informed by current practices within the AI, HCI and Robotics domains.
- Broad and deep knowledge of the HRI areas of AI, data mining, machine learning, search and optimization, intelligent agents, knowledge representation and inference, planning, as well as application-based knowledge and skills relating to HRI, and specialist knowledge and skills in applications relating to a number of specialist areas such as automation, conversational agents, data visualization and analytics, robotics and virtual reality.
- Impart detailed knowledge and critical understanding in core areas of Human Robot Interaction including theories, principles and concepts.
- Inculcate a significant range of principal and specialist skills, techniques and practices in developing Human Robot Interaction applications.
- Cultivate specialist knowledge of computing techniques as they apply to developing applications supporting automation, computer games, big data handling, image processing or machine learning.
- Instil the ability to critically review existing practice and develop original and creative solutions to problems requiring Human Robot Interaction.
- Develop the ability to plan and execute a significant project of research, investigation or development in a specialist area within Human Robot Interaction, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the main theories, principles and concepts relating to the domain of human robot interaction including terminology, conventions, standards and methodologies. ◦
- Understanding and use of a significant range of the main skills, techniques and practices in robotic software engineering, and a range of specialised skills, research and investigation techniques, and practices in human robot interaction informed by current practices within the AI, HCI and Robotics domains.
- Broad and deep knowledge of the HRI areas of AI, data mining, machine learning, search and optimization, intelligent agents, knowledge representation and inference, planning, as well as application-based knowledge and skills relating to HRI, and specialist knowledge and skills in applications relating to a number of specialist areas such as automation, conversational agents, data visualization and analytics, robotics and virtual reality.

Scholarship, Enquiry and Research

- Extensive, detailed and critical understanding of at least one specialist area within the domain of HRI application development obtained through researching the background to a substantial and

challenging HRI engineering project that incorporates a multimodal interface by personal scholarship, design and development of a detailed HRI solution

- Detailed knowledge and understanding of intelligent software engineering relating to multimodal interface application developments as well as the practical skills in how to exploit them in support of original and creative HRI application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of HRI application development including robotics, automation, conversational agents, data mining and data visualization.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current issues within HRI application development, and make informed judgements about them in the light of relevant professional standards.
- Demonstrate an awareness of professional and research issues in the HRI discipline, and an ability to critique current techniques and practice.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
- Develop and utilise advanced problem-solving skills and techniques in the shared development of original and creative solutions to general and specialist HRI engineering issues. ◦
- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Communication, Numeracy and ICT

- Develop and demonstrate the ability to communicate and present the main issues involved in HRI application development to a literate audience with appropriate use of modern presentational tools and aids.
- Demonstrate appropriate use of methods of calculation and estimation involved in planning HRI engineering solutions and solving multimodal interface design of such HRI applications as well as study them from a research perspective.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 4 mandatory courses and students must choose 4 courses from options (see below).

In semester 3 students, who have met the required criteria, will undertake their Masters dissertation

Course Code	Title	Mandatory/ Optional	Credits
Semester 1			
F21HR	Human Robot Interaction	M	15
F21RO	Intelligent Robotics	M	15
F21DL	Data Mining and Machine Learning	O	15
F21GA	3D Graphics and Animation	O	15
F21SA	Statistical Modelling and Analysis	O	15
F29AI	Artificial Intelligence and Intelligent Agents	O	15
B31SC	Digital Signal Processing	O	15
Semester 2			
F21CA	Conversational Agents and Spoken Language Processing	M	15
F21RP	Research Methods and Project Planning	M	15
F21AD	Advanced Interaction Design	O	15
F21BD	Big Data Management	O	15
F21GP	Computer Games Programming	O	15
B31SE	Image Processing	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	Masters Project and Dissertation	M	60

HUMAN ROBOT INTERACTION (2 Years)

Programme Director: Dr Katrin Lohan

The principal aim of the 2 year MSc Human Robot Interaction programme is to equip graduates from non-CS backgrounds with skills and expertise in designing, developing, deploying and maintaining robots that are capable of communicating with and dependably working alongside human beings.

In more detail the MSc's objectives are to:

Stage 1

- Develop skills in software development through imparting detailed and extensive knowledge and techniques in an object-oriented programming language for widespread professional use.
- Cultivate detailed knowledge, theoretical understanding and a good range of practical skills in the fundamentals of artificial intelligence and human computer interaction.
- Impart critical grasp of good practice, methodologies, standards, techniques and tools in software development and its application to artificial intelligence and human computer interaction applications.
- Give a wider knowledge and understanding of Computer Science theory, principles and practice by offering options in mainstream areas of particular relevance to human robot interaction.
- Enable students to communicate and work effectively with peers and academic staff, demonstrating appropriate levels of autonomy, initiative and responsibility.

Stage 2

- Impart detailed knowledge and critical understanding in core areas of Human Robot Interaction including theories, principles and concepts.
- Inculcate a significant range of principal and specialist skills, techniques and practices in developing Human Robot Interaction applications.
- Cultivate specialist knowledge of computing techniques as they apply to developing applications supporting automation, computer games, big data handling, image processing or machine learning.
- Instil the ability to critically review existing practice and develop original and creative solutions to problems requiring Human Robot Interaction.
- Develop the ability to plan and execute a significant project of research, investigation or development in a specialist area within Human Robot Interaction, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the main theories, principles and concepts relating to the domain of human robot interaction including terminology, conventions, standards and methodologies.
- Understanding and use of a significant range of the main skills, techniques and practices in robotic software engineering, and a range of specialised skills, research and investigation techniques, and practices in human robot interaction informed by current practices within the AI, HCI and Robotics domains.
- Broad and deep knowledge of the HRI areas of AI, data mining, machine learning, search and optimization, intelligent agents, knowledge representation and inference, planning, as well as application-based knowledge and skills relating to HRI, and specialist knowledge and skills in applications relating to a number of specialist areas such as automation, conversational agents, data visualization and analytics, robotics and virtual reality.

Scholarship, Enquiry and Research

- Extensive, detailed and critical understanding of at least one specialist area within the domain of HRI application development obtained through researching the background to a substantial and

challenging HRI engineering project that incorporates a multimodal interface by personal scholarship, design and development of a detailed HRI solution.

- Detailed knowledge and understanding of intelligent software engineering relating to multimodal interface application developments as well as the practical skills in how to exploit them in support of original and creative HRI application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of HRI application development including robotics, automation, conversational agents, data mining and data visualization.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current issues within HRI application development, and make informed judgements about them in the light of relevant professional standards.
- Demonstrate an awareness of professional and research issues in the HRI discipline, and an ability to critique current techniques and practice.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
- Develop and utilise advanced problem-solving skills and techniques in the shared development of original and creative solutions to general and specialist HRI engineering issues.
- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Communication, Numeracy and ICT

- Develop and demonstrate the ability to communicate and present the main issues involved in HRI application development to a literate audience with appropriate use of modern presentational tools and aids.
- Demonstrate appropriate use of methods of calculation and estimation involved in planning HRI engineering solutions and solving multimodal interface design of such HRI applications as well as study them from a research perspective.

In Stage 1 students study 8 taught courses (4 mandatory and 4 optional) worth 15 credits each.
In Stage 2 students study 8 taught courses (4 mandatory and 4 optional) worth 15 credits each followed by an MSc dissertation project worth 60 credits.

Course Code	Title	Mandatory/ Optional	Credits
Stage 1, Semester 1			
F21SF	Software Engineering Foundations	M	15
F29AI	Artificial Intelligence & Intelligent Agents	M	15
F21DF	Databases and Information Systems	O	15
F29DC	Data Communications and Networking	O	15
F29KM	Knowledge Management	O	15
C69RP	Research Preparation in English (1)	O	15
Stage 1, Semester 2			
F20AD	Advanced Interaction Design	M	15
F21AS	Advanced Software Engineering	M	15

F21SM	Software Engineering Master Class	O	15
F29OC	Operating Systems & Concurrency	O	15
B59RM	Robotic Mechanical Systems 1	O	15
C69RQ	Research Preparation in English (2)	O	15
Stage2, Semester 1			
F21HR	Human Robot Interaction	M	15
F21RO	Intelligent Robotics	M	15
F21DL	Data Mining & Machine Learning	O	15
F21GA	3D Graphics and Animation	O	15
F21SA	Statistical Modelling and Analysis	O	15
B31SC	Digital Signal Processing	O	15
F21SC	Industrial Programming	O	15
Stage2, Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21CA	Conversational Agents and Spoken Language Processing	M	15
F21BD	Big Data Management	O	15
F21GP	Computer Games Programming	O	15
B31SE	Image Processing	O	15
C11PA	Project Management	O	15
Stage 2, Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

Progression from Stage 1 to Stage 2:

- Progression to stage 2 depends on passing 8 courses at grade D or better with an 8 course average of 50% plus getting a grade C or better on F21SF, F20AD and F29AI. If students are required to take the options C69RP and C69RQ to enhance English to postgraduate study level, then these courses must also be passed at grade C or above.
- Students may retake the assessment of up to a maximum of 3 courses at the next opportunity, subject to payment of the appropriate fees to the University, and may be required to do so to obtain the necessary credits for progression or exit. Students may only resit courses for which their assessment grade is E or F (or a grade D but only if a grade C is required in order to progress to the next stage).
- Students may exit at the end of this stage with a Graduate Diploma in Computer Science if they get credits for 8 courses at grade E or better with an 8 course average of 50%. They may exit with a Graduate Certificate in Computer Science after at least 1 semester of study if they get credits for 4 courses at grade E or better with a 4 course average of 40%.
- Students not meeting either the requirements for progression or for a Graduate Diploma or Graduate Certificate will not be eligible for any award.

INFORMATION TECHNOLOGY (BUSINESS)

Programme Director: Dr Hamish Taylor

This programme is concerned with the use and application of Information Technology in supporting business activities, particularly information handling, communications and management.

Therefore the aims are to enable the students to:

- Develop detailed knowledge and critical understanding of the main areas of information technology usage in business (including theories, principles and concepts)
- Develop and use a significant range of principal and specialist skills, techniques and practices in the domain of business-related information technology.
- Critically review existing practice and develop original and creative solutions to problems within the domain.
- Communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.
- Plan and execute a significant project of research, investigation or development in a specialist area of information technology for business use, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the principal theories, principles and concepts relating to the use of information technology in the business domain.
- Extensive, detailed and critical understanding of at least one specialist area of information technology support for business.
- Understanding and use of a significant range of the principal skills, techniques and practices in necessary to utilise information technology to support business practice, and a range of specialised skills, research and investigation techniques, and practices informed by leading-edge research and development.
- A broad knowledge of the main areas of the use of information technology to support business practices, including terminology, conventions, underpinning theory, techniques and practices.
- Detailed and critical knowledge of at least one area of specialism in information technology for business, incorporating awareness of current issues and research.
- Application-based knowledge and skills relating to the broad range of activities within the information technology and business domain, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.
- Fundamental knowledge and skills in business and information analysis, incorporating specification, design, development and deployment of information technology to meet business need, and critical understanding of the range of tools and techniques available to support this process.
- Extensive and detailed knowledge of structured programming concepts and techniques, with advanced and specialist applicative skills in at least one programming language.
- Extensive and detailed knowledge and understanding of communications and network technologies, and their application in business systems, including the ability to critically analyse and review such technologies to support original and creative application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of business information technology, including databases, information systems, communications, networks, enterprise management and organisational management techniques.

- Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of business information technology, and in the design of projects and experimental models.
- Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues relating to the use of information technology to support business practices.

Scholarship, Enquiry and Research

- Research skills and the capability of critical analysis, through review and analysis of current research literature.
- An understanding of research ethics, and how to appropriately build on the work of others.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current legal, social, ethical and professional issues within the discipline.
- Make informed judgements with incomplete or inconsistent data, or where there are no professional or ethical codes or practices for guidance.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.

Communication, Numeracy and ICT

- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.
- Develop and demonstrate critical knowledge and skills in the planning and usage of software tools and numerical techniques to develop, present and communicate information on projects and processes.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 3 mandatory courses and students must choose 5 courses from options (see below).

In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21IF	Information Systems Methodologies	M	15
F21DF	Databases and Information Systems	O	15
F21SA	Statistical Modelling and Analysis	O	15
F21SF	Software Engineering Foundations	O	15
C11SP	Strategic Project Management	O	15
C11OH	Organisational Behaviour/Human Resource Management	O	15
Semester 2			
F21DE	Digital and Knowledge Economy	M	15
F21RP	Research Methods and Project Planning	M	15
F21BD	Big Data Management	O	15
F21EC	E-Commerce Technology	O	15
F21NA	Network Applications	O	15
C11PA	Project Management	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

INFORMATION TECHNOLOGY (SOFTWARE SYSTEMS)

Programme Director: Dr Manuel Maarek

This programme is concerned with the use and application of Information Technology in the specification, design, development and deployment of software systems. Therefore the aims are to enable the students to:

- Develop detailed knowledge and critical understanding of the main areas of software systems (including theories, principles and concepts)
- Develop and use a significant range of principal and specialist skills, techniques and practices in the domain of software systems.
- Critically review existing practice and develop original and creative solutions to problems within the domain.
- Communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.
- Plan and execute a significant project of research, investigation or development in a specialist area within software systems, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the principal theories, principles and concepts relating to the use of Information Technology in the domain of software systems.
- Extensive, detailed and critical understanding of at least one specialist area within the domain of software systems.
- Understanding and use of a significant range of the principal skills, techniques and practices in software systems, and a range of specialised skills, research and investigation techniques, and practices informed by leading-edge research and development domain of software systems, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.
- A broad knowledge of the main areas of software systems, including terminology, conventions, underpinning theory, techniques and practices.
- Detailed and critical knowledge of at least one area of specialism in software systems, incorporating awareness of current issues and research.
- Application-based knowledge and skills relating to the broad range of activities within the software systems domain, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.
- Fundamental knowledge and skills in the software engineering life-cycle, incorporating specification, design, development and deployment of software systems, and critical understanding of the range of tools and techniques available to support this process.
- Extensive and detailed knowledge of structured programming concepts and techniques, with advanced and specialist applicative skills in at least one programming language.
- Extensive and detailed knowledge and understanding of communications and network technologies, and their application in software systems, including the ability to critically analyse and review such technologies to support original and creative application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of software systems, including databases, artificial intelligence, mobile communications, 3D modelling & animation, computer games programming & internet engineering.

- Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of software systems, and in the design of projects and experimental models.
- Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain of software systems.

Scholarship, Enquiry and Research

- Research skills and the capability of critical analysis, through review and analysis of current research literature.
- An understanding of research ethics, and how to appropriately build on the work of others.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current legal, social, ethical and professional issues within the discipline.
- Make informed judgements with incomplete or inconsistent data, or where there are no professional or ethical codes or practices for guidance.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.

Communication, Numeracy and ICT

- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.
- Develop and demonstrate critical knowledge and skills in the planning and usage of software tools and numerical techniques to develop, present and communicate information on projects and processes.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 3 mandatory courses and students must choose 5 courses from options (see below).

In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21DF	Databases and Information Systems	M	15
F21CN	Computer Network Security	O	15
F21GA	3D Graphics and Animation	O	15
F21RO	Intelligent Robotics	O	15
F21SC	Industrial Programming	O	15
F21SF	Software Engineering Foundations	O	15
Semester 2			
F21NA	Network Applications	M	15
F21RP	Research Methods and Project Planning	M	15
F21AD	Advanced Interaction Design	O	15
F21AS	Advanced Software Engineering	O	15
F21DE	Digital and Knowledge Economy	O	15
F21EC	E-Commerce Technology	O	15
F21GP	Computer Games Programming	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

NETWORK SECURITY

Programme Director: Dr Manuel Maarek

The aim of this MSc programme is to give good honours graduates with an IT background the understanding and skills to elicit network security requirements, analyse security threats, formulate security policies, devise security regimes of mechanisms and services, deploy network security solutions and validate their effectiveness. It also aims to impart detailed understanding and knowledge of contemporary issues in network security research areas.

The aims of the programme are:

- Detailed knowledge and critical understanding of the main areas of computer network security including theories, principles and concepts.
- Significant range of principal and specialist skills, techniques and practices in the computer network security domain.
- Specialist knowledge of security techniques as they apply to developing distributed and networked applications.
- Ability to critically review existing practice and develop original and creative solutions to problems requiring computer network security solutions.
- Ability to communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.
- Ability to plan and execute a significant project of research, investigation or development in a specialist area within computer network security, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the main theories, principles and concepts relating to the domain of computer network security including conventions, methodologies, standards and terminology.
- Understanding and use of a significant range of the main practices, skills and techniques in network security software engineering, and a range of specialised skills, research and investigation techniques, and practices in designing and validating computer network security solutions informed by current best practice.
- Broad and deep knowledge of the computer network security areas of access control, cryptography, means of authentication, network security tools, security policy management, as well as application-based knowledge and skills relating to known security exploits, malware and their detection and prevention, and specialist knowledge and skills in applications relating to a number of specialist areas such as biometrics, firewall management, intrusion detection, penetration testing, public key certificates and user education in good security practice.

Scholarship, Enquiry and Research

- Extensive, detailed and critical understanding of at least one specialist area within the domain of Computer Network Security application development obtained through researching the background to a substantial and challenging network security engineering project that addresses a real or simulated sets of threats by personal scholarship, design, development and testing of a detailed means of prevention.
- Detailed knowledge and understanding of network security software engineering techniques relating to authentication, authorisation and auditing as well as the practical skills in how to exploit them in support of original and creative network security application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of network security application development including cryptography,

digital forensic techniques, malware analysis, network defence technologies and penetration testing.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current issues within network security application development, and make informed judgements about them in the light of relevant professional standards.
- Demonstrate an awareness of professional and research issues in the network security discipline, and an ability to critique current techniques and practice.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
- Develop and utilise advanced problem-solving skills and techniques in the shared development of original and creative solutions to general and specialist network security engineering issues.
- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Communication, Numeracy and ICT

- Develop and demonstrate the ability to communicate and present the main issues involved in network security application development to a literate audience with appropriate use of modern presentational tools and aids.
- Demonstrate appropriate use of methods of calculation and estimation involved in planning network security engineering solutions and deploying and validating such solutions.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 4 mandatory courses and students must choose 4 courses from options (see below). In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

* - chose only one of these courses.

Course Code	Title	Mandatory/ Optional	Credits
Semester 1			
F21CN	Computer Network Security	M	15
F21SC	Industrial Programming	M	15
F21DL	Data Mining and Machine Learning	O	15
F21RS*	Rigorous Methods for Software Engineering	O	15
F21SF*	Software Engineering Foundations	O	15
F29DC	Data Communications and Networking	O	15
Semester 2			
F21AN	Advanced Network Security	M	15
F21RP	Research Methods and Project Planning	M	15
F21AS	Advanced Software Engineering	O	15
F21BD	Big Data Management	O	15
F21DP	Distributed and Parallel Technologies	O	15
F21NA	Network Applications	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	Masters Project and Dissertation	M	60

SOFTWARE ENGINEERING

Programme Director: Dr Manuel Maarek

This programme is designed to impart the understanding and skills to engineer software at an advanced level to professional standards. It has an emphasis on developing dependable systems to meet society's growing demand for software applications suited to supporting critical services. It teaches computing graduates how to use state-of-the-art techniques and methodologies to develop reliable, safe, secure and trustworthy software.

Therefore the aims are to enable the students to:

- Develop detailed knowledge and critical understanding of the main areas of software engineering for dependable systems development (including theories, principles and concepts).
- Develop and use a significant range of principal and specialist skills, techniques and practices in the domain.
- Critically review existing practice and develop original and creative solutions to problems within the domain.
- Communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.
- Plan and execute a significant project of research, investigation or development in a specialist area within mobile software systems, demonstrating extensive, detailed and critical understanding of that specialism.

The Programme provides opportunities for learners to achieve the following outcomes:

Understanding, Knowledge and Cognitive Skills

- Critical understanding of the principal theories, principles and concepts relating to the development of reliable, safe, secure and trustworthy software.
- Extensive, detailed and critical understanding of at least one specialist area within the domain of software engineering.
- Understanding and use of a significant range of the principal skills, techniques and practices in engineering dependable software systems, and a range of specialised skills, research and investigation techniques, and practices informed by leading-edge research within the domain.
- A broad knowledge of the main areas of software engineering, including terminology, conventions, underpinning theory, techniques and practices.
- Application-based knowledge and skills relating to the broad range of activities within the domain, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.
- Extensive and detailed knowledge of high integrity programming concepts and techniques, with advanced and specialist applicative skills in at least one programming language.
- Extensive and detailed knowledge and understanding of software engineering methodologies, and their application including the ability to critically analyse and review such methodologies to support original and creative application development.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of software engineering, including mobile networking, automated software engineering and information systems methodologies.
- Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of mobile software systems, and in the design of projects and experimental models.
- Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain.

Scholarship, Enquiry and Research

- Research skills and the capability of critical analysis, through review and analysis of current research literature.
- An understanding of research ethics, and how to appropriately build on the work of others.

Industrial, Commercial and Professional Practice

- Demonstrate critical awareness of current legal, social, ethical and professional issues within the discipline.
- Make informed judgements with incomplete or inconsistent data, or where there are no professional or ethical codes or practices for guidance.

Autonomy, Accountability and Working with Others

- Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.

Communication, Numeracy and ICT

- Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.
- Develop and demonstrate critical knowledge and skills in the planning and usage of software tools and numerical techniques to develop, present and communicate information on projects and processes.

Students take 8 courses, 4 each in semesters 1 & 2, including a taught Research Methods and Project Planning course in semester 2. There are 4 mandatory courses and students must choose 4 courses from options (see below).

In semester 3 students, who have met the required criteria, will undertake their Masters dissertation.

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21IF	Information Systems Methodologies	M	15
F21RS	Rigorous Methods for Software Engineering	M	15
F21BC	Biologically Inspired Computation	O	15
F21CN	Computer Network Security	O	15
F21GA	3D Graphics and Animation	O	15
F21SC	Industrial Programming	O	15
Semester 2			
F21AS	Advanced Software Engineering	M	15
F21RP	Research Methods and Project Planning	M	15
F21AD	Advanced Interaction Design	O	15
F21BD	Big Data Management	O	15
F21DP	Distributed & Parallel Technologies	O	15
F21GP	Computer Games Programming	O	15
C11PA	Project Management	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

Overview and Structure

The University operates the Heriot Watt Assessment and Progression System (HAPS) which specifies minimum progression requirements. Schools have the option to apply progression requirements above the minimum University requirement, which are approved by the Studies Committees. Students should refer to the programme specific information on progression requirements. This information is detailed later in this handbook.

Course Summaries
Please refer to Appendix A.

Many of the courses have on-line material available at the University's Virtual Learning Environment (VISION) which can be found at: https://vision.hw.ac.uk

Course Choices
Students select course choices at the pre-enrolment session with guidance from the Programme Director, but may change their selection in the first two weeks of the semester that the relevant course runs.

Any changes to optional course selection made after on-line enrolment must be made under the guidance of the Programme Director. An Optional Course Change Form can be found in the School Office (EM 1.25) and once this has been signed off by your Programme Director it should be handed into this office to update your student record.

Class Timetables
These can be found at: https://www.hw.ac.uk/students/studies/timetables.htm

Teaching and Learning Approaches and Expectations
The programme is taught primarily in a traditional lecture-based approach, with a variety of supporting laboratory-based practicals. Students may be expected to complete coursework in groups, teams and pairs, as well as individually, and courses offer a range of types of coursework for assessment, from discursive essay-style assignments to code design and generation. In some courses, team teaching approaches are adopted to provide additional support and variety, and electronic support, in the form of email lists, newsgroups and bulletin boards may be used to disseminate information and support student communication and practice.

As it is a postgraduate programme students must develop advanced skills that go beyond that required for undergraduate programmes. Students are expected to be able to *critically evaluate* the techniques and methodologies they are taught, not simply apply the skills. The examinations will test abilities not just to recall and apply techniques, but to provide, for example, a discussion of their advantages in particular unseen cases. Students also are expected to develop a level of professional awareness, and skills in team working and communication.

Heriot-Watt University does not tolerate plagiarism on any level. Work presented as your own must be your own and not use any words or code copied from others without proper signification and acknowledgement. More information is available in the Postgraduate handbook. If you copy coursework, or if you cut-and-paste material from the Web and pass it off as your own words, then you will be sent to the Disciplinary Committee. In some cases students may be compulsorily withdrawn from the University as a result.

MSc Staff/Student Liaison Committee
The purpose of the MSc Staff/Student Liaison Committee is to provide a forum at which representatives from the student body can discuss matters of mutual interest and/or concern with the academic and support staff of the School. Subjects raised at these meetings have ranged from programme structures and content to the provision of services such as vending machines and air-conditioning.

The MSc programmes offered by the department are represented by a number of elected representatives. Students wishing to be considered for election should make themselves known to their Programme Director at the start of the academic year.

The role of MSc student representatives is to ascertain and communicate the views of the MSc students they represent to either individual members of staff or to the MSc Staff/Student Liaison Committee.

The MSc Staff/Student Liaison Committee usually meets once each semester and the minutes of its meetings are made available to all staff and taught postgraduate students.

Further information can be obtained from: Dr Hamish Taylor (H.Taylor@hw.ac.uk).

Programme & Examination Requirements

Attendance
In order to achieve course and programme learning outcomes, students are expected to attend all scheduled course learning sessions (e.g. timetabled lectures, tutorials, lab sessions, etc). Should you have to missed a timetabled session due to ill health or other legitimate reasons, you should submit a self-certification or medical certification or an application for consideration of Mitigating Circumstances https://www.hw.ac.uk/students/studies/examinations/mitigating-circumstances.htm

Students who fail to satisfy course attendance requirements may, after due warning, be disallowed from presenting themselves for examination in the course (see https://www.hw.ac.uk/students/doc/withdrawalprocedures.pdf).

Coursework must be handed in by the stipulated dates, and students are required to see their personal tutors at agreed times. Students who fail to submit compulsory coursework may also be disallowed from presenting themselves for examination in the relevant courses.

All lectures and tutorials are compulsory and registers of attendance may be taken.

If you are absent from class due to illness for four days or less, you should complete a self-certification form, obtainable from the School Office (EM 1.25), and return it to the School office within a week of your return. If you are absent for more than four days, you must supply a medical certificate to the School Office within a week of your return.

Students here on a Tier 4 Student Visa must check-in as required. It is your responsibility to make sure that you check-in as instructed. Failure to will mean that you will be reported to UKVI and your right to remain in the UK maybe removed.

Course Assessment
Courses on the programme may be assessed by coursework only, or by a mixture of coursework and examination.

For all courses students are required to complete all assessed coursework work by the deadline given, and to a satisfactory level. Failure to do so may mean that you will be unable to receive any award.

In some taught courses there is an exam. This is held at the end of the relevant Semester (see Calendar on page 2). Examination marks are weighted with any coursework mark (typically 80%-20%) to provide a final mark. There is a nominal pass mark on a course basis. However, assessment marks are averaged for progression purposes (see below).

Past exam papers can be found at: https://www.macs.hw.ac.uk/students/cs/past-exam-papers/.

Past exam papers are only accessible on-campus or if you use the VPN:
https://www.hw.ac.uk/services/is/it-essentials/virtual-private-network-vpn.htm

For courses assessed by coursework only (including the project), coursework-based summative assessment within and at the end of the course will provide a mark and grade.

Grades & Assessments
Grades for each course are awarded as follows:

Grade A	Excellent	Overall mark of approximately 70% or more
Grade B	Very Good	Overall mark of approximately 60% to 69%
Grade C	Good	Overall mark of approximately 50% to 59%
Grade D	Satisfactory	Overall mark of approximately 40% to 49%
Grade E	Adequate	Overall mark of approximately 30% to 39% Minimum required for the award of credits
Grade F	Inadequate	Fail

Examinations
It is the student's responsibility to check all relevant examination timetables (including resits) on the Registry web page https://www.hw.ac.uk/students/studies/examinations.htm

The semester 1 exam timetable will be available on 31 October. The semester 2 exam timetable will be available on 28 February.

Should you be required to be re-assessed in any examinations, you *must* be available to take them. The re-assessments take place in early August. The re-assessment timetable will be available on 17 July.
All examinations must be taken at the Edinburgh Campus.

Calculators, Dictionaries & Electronic Devices
Where a calculator is required for the completion of an examination, a student may use any basic scientific calculator, except the following: graphics calculator, programmable calculator and a calculator which features text storage or retrieval facilities.

No translation dictionaries are permitted in any of the University's examinations. The only exception to the policy is in the case of individual students who had been assessed by the University's Disability Service as requiring access to a translation dictionary.

Students are not allowed to have mobile phones or other communication devices on or about their person during examinations. Phones may be left at the front of the examination room but must be switched off.

Unauthorised Material
You must not have any unauthorised pre-printed materials or electronic devices including mobile phones in the examination room. Cheating in an examination is treated very seriously by the University. If you do have any material relevant to the exam which you have brought in by mistake, you must hand it over to an invigilator before the start of the examination. Invigilators will carry out checks on authorised materials and calculators.

Submission of Coursework Policy
The University recognises that, on occasion, students may be unable to submit coursework and dissertations by the submission date. As such, the University has agreed a new policy from 2018/19 which states:

- No individual extensions are permitted under any circumstances (unless course coordinators decide to give an extension to an entire class);

- Standard 30% deduction from the mark awarded (maximum of five working days);
- Alternative options if students cannot submit coursework or their dissertation on time

In the case where you submit coursework up to five working days late and you have valid mitigating circumstances, the mitigating circumstances policy will apply and appropriate mitigation will be applied.

Formative feedback will be provided on all coursework submitted up to five working days late.

Any coursework submitted after five calendar days of the set submission date shall be automatically awarded a no grade with no formative feedback provided.

There will be no extensions granted to coursework (this includes undergraduate and postgraduate taught dissertations).

A link to the policy can be found here https://www.hw.ac.uk/services/docs/CourseworkPolicyFinal.pdf.

Submission of Coursework
If you are required to submit physical coursework, it must be submitted by 3.30pm on the deadline date unless otherwise specified by the lecturer. Coursework Submission front sheets are available in the Earl Mountbatten Building **along from** the School Office (Room 1.25). The coursework submission front sheets are printed on **lilac** coloured paper. Please ensure that you:

1.	state which **MSc programme** you are studying.
2.	Complete your **personal details** on the form, i.e., your name, matriculation number.
3.	Write the **course code** and **course title** on the front sheet.
4.	**Sign** and **date** the front sheet to confirm that it is your "sole and original work ……."
5.	**Staple** the front sheet to your coursework **before** you put it in the CS coursework box.

Feedback
Feedback is a two-way process. Feedback is provided to students in a variety of ways in order to help you to reflect on and to evaluate your progress and to assist you to take steps to improve before the next relevant assessment. For most courses, students can expect feedback on assessed coursework within three teaching weeks of the coursework due date.

Feedback is sought from students via Student-Staff Liaison Committees and various surveys so that the School can continue to enhance the student learning experience. Your feedback is valued by the School, so please be sure to provide feedback whenever it is sought.

Assessments Results
Details on how and when you will receive your Assessment Results can be found at: https://www.hw.ac.uk/students/studies/examinations/results.htm

The official mechanism for receiving all your assessment results is on-line at http://www.hw.ac.uk/selfservice.

You will officially receive the provisional results of your semester 1 assessments in mid-January. You will receive the final results of your semester 1 & 2 assessments in mid-June. You will receive your dissertation result and your award recommendation in mid-September. You will receive an email to your University email account to inform you when you can view your official results on-line at http://www.hw.ac.uk/selfservice.

You will receive a final assessment results letter with your award recommendations in mid-September. This letter will be sent to your correspondence address so you must make sure that you update this.

On-line results show marks and grades while your official Assessments Results Letter will only show grades.

Progression to Dissertation
To pass your MSc you must obtain a credit weighted average of 50% or more over all 8 taught courses at grades A to D, a mark on F21RP Research Methods of 45% or above, and a grade C or better in your MSc project. However, students must also fulfil a progression requirement after doing the 8 taught courses before they are allowed to attempt to complete their MSc project. It requires them to obtain the credit weighted average of 50% or more over all 8 taught courses at grades A to D and at least 45% on F21RP beforehand.

MSc students, who fail to meet the progression requirement, may be able to meet it by doing resits as detailed below. If improved marks obtained in resits then enable the student to meet it, the student may continue at that point with their MSc project.

The Masters dissertation counts as 600 effort hours (4 courses), in Semester 3. Detailed guidelines on the conduct of the project and the production of the dissertation are provided in Appendix B, MSc Project Guidance.

The final dissertation is submitted in mid-August (see dates). Students may choose to demo their work to their supervisor or second reader.

Students may graduate with a Postgraduate Diploma without doing the main project. In this case, the requirement is to get a credit weighted average of at least 40% over all 8 taught courses (including Research Methods), with at least grade E passes in all of them.

Further details on the MSc Dissertation are given in Appendix B.

Re-Assessment Opportunities
Students will be able to be re-assessed in a **maximum of 3 courses**. Where this is by examination it will be at the next opportunity (there is normally a resit diet in August), subject to payment of the appropriate fees to the University, and may be required to do so to obtain the necessary credits for completion of their programme or for progression.

A student who has been awarded a Grade E or a Grade F in a course may be re-assessed in that course. A student who has been awarded a Grade D in a course may be re-assessed in that course in order to proceed to, or be eligible to receive the award of, Masters.

There is no non-discretionary re-assessment opportunity for the Dissertation.

Mitigating Circumstances
If you experience any mitigating circumstances which affect your ability to complete your assessments you must notify us as soon as possible.

You should read the University's Policy on Mitigating Circumstances in Relation to Assessment and then complete the application form at:
https://www.hw.ac.uk/students/studies/examinations/mitigating-circumstances.htm

This form along with any relevant evidence (eg medical certificates) should be submitted to the School Office. Evidence submitted after your results have been published cannot be taken into account.

Award Criteria

	No. of Course Passes (Credits)	Overall Mark/Grade	Basis of Overall Mark/Grade	Other Requirements
MASTER DISTINCTION	9 (180)	>= 70%/ A	Credit weighted average >=70% over 8 courses at grades A-C plus a dissertation/project at grade A	Minimum grade of 45% in F21RP
MASTER	9 (180)	>= 50% / C	Credit weighted average >=50% over 8 courses at grades A-D plus a dissertation/project at minimum grade C	Minimum grade of 45% in F21RP
DIPLOMA DISTINCTION	8 (120)	>= 70% / A	Credit weighted average >=70% over 8 courses at grades A-C	
DIPLOMA	8 (120)	>= 40% / D	Credit weighted average >=40% over 8 courses at grades A-E	
CERTIFICATE	4 (60)	>= 40% / D	Credit weighted average >=40% over 4 courses at grades A-E	

Full details of award and progression rules are in Appendix C.

Prizes

The following prizes are available to each MSc cohort:

- Dr Alison Cawsey Memorial Prize for the most deserving MSc student (£200) – Edinburgh & Dubai
- School Prize for best MSc student (£200) - Edinburgh & Dubai
- School Prize for best MSc Dissertation (£200) - Edinburgh & Dubai

Graduation

When you have completed your degree your award is conferred at a graduation ceremony. Details on graduation, including how to apply, deadlines for applying and the cost, can be found at: https://www.hw.ac.uk/students/studies/graduation.htm. This website also includes details of gown hire and guest tickets.

Graduate Attributes

As a student of Heriot-Watt University, you are part of our global community. You will meet new people, discover new interests, develop your life skills and enhance your employability and career prospects. The University will provide you with opportunities to develop skills, qualities and academic abilities during your time as a Heriot-Watt student. These are known as the **Four Heriot-Watt Graduate Attributes**:

- ***Specialist***
- ***Creative***
- ***Global***
- ***Professional***

Further information can be found
at: https://www.hw.ac.uk/students/doc/StudentGraduateAttributes.pdf

Thinking of Leaving
Many students think about leaving university at some stage during their studies. If anything is bothering you or you are thinking about leaving, please speak to a member of staff to explore and understand what you can do.

There may be other options such as additional help (perhaps advice on how to improve your academic skills), a temporary suspension of studies or transferring to another programme.

Further information is available at: https://www.hw.ac.uk/students/studies/leaving.htm

Complaints and Appeals
Our aim at Heriot-Watt is to ensure that your experience while studying with us is of the highest quality. However, we recognise that during your time at the University there may be circumstances that occur where you feel you need to make a complaint or to appeal a decision.

Further information is available at: https://www.hw.ac.uk/students/studies/complaints-appeals.htm

General
Information concerning semester dates, examination timetables, graduation, University Regulations and other general information can be found on the Academic Registry website at https://www.hw.ac.uk/students/index.htm

Communication
Please check your University email regularly – we will use this method of communication to send out important information with you.

Please make sure that we have your current correspondence, home and term address at all times. You can update these via student self -service - http://www.hw.ac.uk/selfservice

Please note that your final assessment results letters will be sent to your correspondence address

Dealing with Problems
If you or your class has any concerns about the programme, please talk to the lecturer concerned or to your Programme Director. They will be very willing to help. Please speak to your lecturer after the lecture, or email your lecturer or programme director to make an appointment. If you have personal problems that are getting in the way of your study please contact your personal tutor. In most cases this will also be your Programme Director.

If you or your class have general concerns which you are unable to get resolved then there is a Staff/Student Liaison Committee which meets regularly to discuss student concerns. You will have one or more MSc representatives on this committee who you can talk to, who will then bring it up with the committee.

Lockers
Lockers for use by students are available at a number of sites in the Earl Mountbatten Building. They are allocated for the duration of each academic year on a first-come first-served basis. Keys for lockers in the EM Building are available for a deposit of £10 from the School Office.

Mail
Mail (internal and external) to students is delivered to pigeon holes in the Earl Mountbatten Building, to the School Office (EM 1.25). Check yours regularly.

Notice Board
Various notices are posted on the notice boards in the first floor corridor along from the School Office in the Earl Mountbatten Building.

Wider Support
For more general problems, your personal tutor is available to offer support, advice, and help if you run into difficulties, be it personal or academic. They will offer assistance as far as they can, and can put you in touch with appropriate University support services. The University offers a wide range of support services for students and you are encouraged to make use of these to make your time at Heriot-Watt as enjoyable and trouble-free as possible.

The Chaplaincy *welcomes all students from any background and is available for prayer, counselling and support and social events. See:* https://www.hw.ac.uk/students/health-wellbeing/edinburgh/faith/chaplaincy.htm*; email: chaplaincy@hw.ac.uk*

Student Support and Accommodation *provides student counselling and welfare support. See:* https://www.hw.ac.uk/students/health-wellbeing.htm

University Health Service is *available to all students. You can make an appointment to see a doctor by telephoning 451 3010 or dentist by telephoning 451 3080. See: http://www.hw.ac.uk/students/health-wellbeing.htm*

International Student Advisors are available to provide *advice and support with visas, studying in Scotland and any other general support and advice to international students. See: https://www.hw.ac.uk/students/international/uk.htm*

Heriot-Watt Students Union *see:* https://www.hwunion.com/

Careers Advisory Service *has in-house advisers with considerable expertise in the actuarial and financial job market and can assist with job applications and preparing for interviews. See https://www.hw.ac.uk/students/careers.htm or contact Alan Smith (telephone 451 3390 or email A.Smith_3@hw.ac.uk).*

Academic Skills Service provides *coaching and counselling to assist students to work smarter. See: https://www.hw.ac.uk/study/foundation/academic-skills.htm*

Also see the A-Z guide for students https://www.hw.ac.uk/students/doc/a-z-students-ed-sbc.pdf

APPENDIX A

Course Descriptors

These can be found at:
http://www.macs.hw.ac.uk/students/cs/courses/

The University reserves the right to withdraw or modify the content of any course

APPENDIX B

MSc Project Guidance

MSc Project Guidance

The following section gives information about the conduct of MSc projects and the preparation and submission of MSc dissertations. Further information and advice is provided in the F21RP Research Methods and Project Planning course.

MSc Project Conduct and Milestones

An MSc project is a substantial and extensive investigation of a challenging topic in the subject area of an MSc. It is intended to give an MSc student a major opportunity to exercise their new understanding and advanced skills acquired on their programme by applying them to a significant and advanced practical problem. It is primarily assessed by means of a major piece of writing that describes the full scope of their MSc project from its aims and objectives through its requirements analysis, design of software or experiments to implementation, summative evaluation and conclusions. Students are supervised by a qualified academic with expert knowledge in the subject area while they are doing the MSc project.

Preparations for the MSc project begin in the second semester on the mandatory course F21RP Research Methods and Project Planning. That course develops student skills in critical thinking, research planning, academic writing and experimental design appropriate to their MSc project. It also explains appropriate approaches to planning the project. Students are made aware of legal, social, ethical and professional issues at stake and how to address them. Students are expected to meet with their supervisors throughout semester 2 for guidance and assistance in researching the background to their project. This research phase issues in the student writing a research background report which is part of the assessed coursework for the F21RP course.

The research background report has 4 main elements:

1. Literature review
2. Requirements analysis of software or experiments to be attempted
3. Project plan
4. Professional, Legal, Ethical and Social Issues

The first two elements can also be used as part of the MSc dissertation after suitable revision to reflect any changes in the project's direction and details.

Immediately after the MSc exams at the end of semester 2, students begin work on their MSc project and continue full time on the project for 15 weeks until near the end of August. At that point they submit an MSc dissertation, as described below.

The milestones of an MSc project are as follows:

1. project selection period at start of semester 2
2. project allocation in following week
3. research background to MSc topic completed by end of semester 2
4. begin full-time project immediately after end of semester 2 exams
5. project dissertation submission towards the middle of August

See the earlier MSc calendar for the exact dates.

MSc Project Selection

At the start of the second semester MSc students will be invited to select their MSc project. Students can either select projects from a list of projects that will be made available on the web or they can propose their own project. Lectures on the course F21RP Research Methods & Project Planning will give guidance on this process.

Projects listed on the web will include the proposed project title, the proposer, a description of its content, some references, an optional hyperlink to further details and the kinds of knowledge and skills that are required to attempt it. The project proposer will be an academic in the department and that person will normally supervise the project. However, in some cases the project will be developed in collaboration with an external organisation and the department will appoint a supervisor to oversee the project which may take place partly within that organisation. Project selection is done online by filling a form specifying 1st, 2nd and 3rd choices. In cases where the project title is very generic, the actual project attempted and its final title will be determined by negotiation between the student and their supervisor. Students are advised to contact the project proposer and discuss what the project involves and whether they are suitable before making a project selection. After the selection deadline has passed, students will be informed as to who has been allocated which project. This allocation is done so as to try to ensure that every student has as close to their 1st choice as possible.

Students may also propose their own project. If they do so, they should write on an A4 page, the project's title, a description of its content, their name and programme being studied, and detail any special software or equipment requirements. The level of detail required should be similar to the level of detail given in published project proposals by academics. The student should then submit the MSc project proposal to their programme director. Their programme director will be responsible for vetting the project for suitability and then if it qualifies or qualifies after being suitably amended, their programme director will also help them find them a supervisor.

Either way the student will fill in the MSc project form once it has been agreed and get their programme director and supervisor to sign it. It should then be submitted to the academic in charge of the MSc project who manages project allocation. Problems about project allocation can be resolved through the academic in charge of the MSc project and their programme director.

MSc Project Supervision

Once an MSc student has been given a supervisor, the student should seek an early meeting with that supervisor. Students are expected to meet with their supervisor once a week until the end of their MSc project. It is the student's responsibility to make that first meeting, and it is the student's responsibility to ensure that they attend every weekly meeting throughout the entire project period. Failing to meet your supervisor regularly every week is a fairly good way of setting yourself up to fail your MSc project. Arranging to meet a supervisor can be done either in person by going to that academic's room in the department during office hours or by asking for an appointment by e-mail.

Even the cleverest MSc student is unlikely to be able to anticipate all the guidance that can be obtained from their supervisor. Only by attending supervisions is a student going to be well placed to get a good mark on their MSc project. MSc projects require research, practical work and writing. Students can expect extensive help with all these aspects from their supervisor.

MSc Dissertation - Format and Length

As a general rule, the body of the dissertation should be between 15,000-20,000 words - this will normally correspond to about 45-60 pages if you include some diagrams. Dissertations which are significantly outside this range may be penalised for being too short or too long. We don't have a prescriptive style/format, but you should choose a font that is easy to read (normally 10 or 12 point) and are encouraged to use one-and-a-half line spacing. You should include appendices for additional material not central to the report (e.g., questionnaires, screenshots) and these will be in addition to the 45-60 pages for the main body.

MSc Dissertation - Content and Structure

Your project will be assessed primarily from the dissertation and it is therefore essential that it is a full account of your work and clearly presented. The detailed structure will depend on the type of project, and you should obtain advice from your supervisor. Your supervisor can also be expected to comment on outlines and drafts. When writing your dissertation, make sure to pitch it at the right level. You should not

assume that your reader is an expert in the specialist topic that you are reporting, but should assume they have a good knowledge of the general discipline (CS/IT). If you think a good fellow student would understand it, then that is about right.

All dissertations will normally have the following elements:

- Title Page
- Declaration that the dissertation is your own work (see discussion in section on submission)
- Abstract: A summary of the dissertation highlighting major points and describing the dissertation's scope and conclusions.
- Acknowledgements: Anyone you wish to thank.
- Table of Contents: Detailed breakdown with chapter headings, section headings, and maybe subsection headings, each with page numbers.
- Table of Figures: Location, number and legend of all figures in document (optional)
- Chapters of Content (see later)
- References (see later)
- Bibliography (optional - recommended reading such as sources that you have used but not cited)
- Appendices (optional)

Chapter 1 will normally start with a short introduction to the problem you are addressing and your aims and objectives, give a short review of the context, and describe what follows in the main body of the report.

Chapter 2 will normally include a critical review of relevant literature, so the reader understands what you are building on. You may also describe techniques, guidelines and even existing products if relevant to what you will be presenting later. It is important that this review is written in your own words throughout, reads as a coherent and connected piece of writing, shows the *relevance* of the material presented to the problem being addressed, and provides some critique/analysis of the material and its applicability to the problem. In essence it is your analysis and understanding that we are interested in, how you build on existing work, understand its limitations, select from available methods/tools, and present that coherently.

It is important to select your *references* carefully in your review. It is not sufficient to find 15 web sites which seem to have something relevant to say. Sources should be authoritative, accurate, and preferably should still be around in 5 years time. Academic papers and books usually meet these criteria, but also some web site sources are acceptable - sometimes a web site is indeed the most appropriate and authoritative source on a subject. See later for how to cite your references.

The structure of the middle section of your dissertation will vary according to the type of project. Many possible structures are possible but two typical structures are discussed below:

A. Software Engineering Project.

The goal is to develop some software to solve some problem. The chapters should cover requirements, design, prototyping and redesign, implementation, evaluation, conclusion.

This structure is appropriate where you have a customer (external or supervisor) who wants some software for a real (or imagined!) problem. A successful project is one where you elicit the customer's needs, develop a reliable and functional solution, and test/evaluate the software to demonstrate that it does indeed meet the customer's needs. It should also of course be technically non-trivial. A simple set of web pages might satisfy some customers but would not result in you getting an MSc.

B. Research Project:

The goal is to advance understanding by carrying out an investigation which may include prototyping a system. The chapters will present the problem (sometimes as a hypothesis), review existing work (as

above), describe the research undertaken (including design of any experiments), present the results of any experiments, present any conclusions, relating these to past work and suggesting further work.

This structure is appropriate for open-ended investigations inspired by either a novel idea (like "The use of multimedia can negatively affect the experience of learning") or a plausible principle or hypothesis (such as "Distribution of a database provides information access speedup"). The aim is to investigate something about which not enough is already known or understood, and hence make a modest contribution to knowledge. Where a program is developed, it is not an end in itself. Rather it is an instrument for experimentation and discovery. The interest, significance and quality of the results are the primary criteria of success (bearing in mind that negative results of a well-conducted investigation are often as valuable as positive.)

Many variants of these structures are possible. For example, some projects will centre on the evaluation of an existing software system, and the structure will reflect that. Some projects may involve surveys of user or organisation opinion, and it may be the design of these surveys that forms a central element. Don't feel constrained to structure your document in a particular way, but ensure that the structure is discussed with your supervisor.

Note that in both styles of dissertation the final chapter will normally present conclusions and discuss further work. It should be clear just what has been achieved against the original objectives/problem description set out in chapter 1. It is important to make clear what has been learned and achieved and what further work could be undertaken by you or others to further the objectives of the project.

MSc Project Evaluation

It is not enough to achieve something in doing your MSc project by way of software development or by conducting some experiment. You also need to demonstrate the worth of what you have achieved by some kind of independent standard other than your own satisfaction with what you have done. With a software development project you can do this by conducting an evaluation with the help of some third parties.

Evaluation is different from testing your software. The aim of testing is to verify that your software does what it is designed to do. The aim of evaluation is to validate that your software fulfils the project's requirements. A minimum evaluation might be a checklist comparison of what the original requirements were and what you succeeded in implementing. However, this is usually insufficiently convincing as it is too simple to subvert. You could easily rewrite the requirements to fit with whatever software you succeeded in producing and give yourself a perfect evaluation score.

More convincing is to conduct an evaluation where you exercise your software in accordance with the project aims and get independent persons to give judgements about the worth of what you have done. Since most software is interactive, a typical evaluation might consist of giving users a series of representative tasks to perform using the software and assessing how well they succeeded in doing them. You could record whether they succeeded or needed help to succeed or gave up or failed and score how well they succeeded in doing (efficacy, accuracy, time, effort etc.) The testers can contribute to that assessment by filling in a questionnaire addressing a range of usability and functionality aspects of the system. Their judgements would help establish the independence of the evaluation. The questionnaire could ask users to rate aspects of the system along various quality dimensions and you could provide average scores of these ratings. The questionnaire could also ask users to give free text comments about what worked and what needs improvement. The number and choice of testers needn't be so numerous and balanced that they would eliminate all biases to a scientific level of respectability. However, between 5 and 10 testers of varied character should be enough to be reasonably indicative of how well your software does what it is supposed to and what its shortcomings are.

Your evaluation should be written up and presented in your dissertation after you describe what you have achieved. Usually you would present this in a special chapter by itself. No software is perfect so the

evaluation is likely to reveal shortcomings. You shouldn't try to hide or disguise them. You are unlikely to convince your dissertation markers that your software was one big success story if your evaluation just presents a bland picture of a successful outcome. You should turn around the shortcomings by being honest and realistic about them and even take the opportunity to say how they might be ameliorated. That self-critique is often the most interesting part of a dissertation. It is also a hallmark of a good project write-up that the author is capable of recognising the project's limitations and can clearly see what needs improving.

MSc Dissertation References

Your dissertation may cite a wide range of sources (e.g., papers or web sites that you have used) as background and context for the work. Sources are cited at the relevant point in the text and full source information is given in the references section. There are a variety of acceptable citation and referencing styles, but the most commonly used styles in Computer Science are the Harvard style and the IEEE style. These are briefly discussed below.

Harvard (author-date) style

The author's name and the date of publication are used in the body of the text when citing sources - e.g., (Jones, 2003). Variations are possible, for example we can say that Jones (2003) has developed a new technique. The bibliography is given alphabetically by author. Journal and book names are italicised, e.g.

> Annas, G.J. (1997), 'New drugs for acute respiratory distress syndrome', *New England Journal of Medicine*, vol. 337, no. 6, pp. 435-439.
>
> Grinspoon, L. Bakalar, J.B. (1993), *Marijuana: the forbidden medicine*, Yale University Press, London.

Notice that there is a lot of information about the articles cited, not just the title and author. This ensures that the reader can find the article in question. Find out what is expected for different types of article (e.g., books, conference papers) and aim to give as complete information as possible.

IEEE style

Here references are listed alphabetically but given a number. The citation number is used when citing the document in the body of the text (e.g., [2]). Differences in how the references are listed are otherwise minor.

> [2] W. Chen, R. Yeung, and P.P. Wainwright, "Linear networks - assessing their feasibility", *Phys. Rev.,* vol. 12, no. 1, pp. 105-119, April 1994.

You should select which style to use and use it consistently. Look up how to reference different kinds of sources, taking particular care with electronic sources. Give as much information about these as possible (title, author, date if possible) and consider just using footnotes for non-authoritative electronic sources. If you want to use another style apart from IEEE and Harvard then you should discuss it with your supervisor.

With the increasing use of Web sources you should take particular care how you cite these. You should make sure to put more than simply the URL, as URLs often go out of date. The guiding principle is that you should maximise someone's chances of finding the document. You should also state when the web page was last accessed, as web resources often change their location. One format that you can use is the following:

Author's name, title of document, publisher, date of document, size of document, URL web address, (date last accessed)

For example, using the Harvard style we might have:

> Taylor, H., (2009), *MSc Dissertation Preparation Guidance*, Heriot-Watt University, 29572 bytes, http://www.macs.hw.ac.uk/macshome/courses/pg/diss_prep.html, (last accessed 1/5/2009)

Whatever style you use the references section should come between the main text and the appendices. Normally references should start on a new page, and should not have a chapter or section number, just the heading "References". Some word processing tools may provide help with referencing - consider using these. However, the main thing is to give proper thought to how and what you cite.

MSc Dissertation Style

Style in technical writing is discussed in more detail elsewhere. See for example:

The Elements of Style: A Style Guide for Writers (2005), by William Strunk, ISBN 0-97522-980-X, http://academic.csuohio.edu/simond/courses/elos3.pdf

The main point to make is to present material clearly and concisely, and in an objective fashion as possible. Your personal impressions and feelings should rarely come into it. You should normally avoid using expressions like "I did this" and instead report the work in a passive voice ("it was done"). However, where you are genuinely voicing an individual opinion, you may use the first person. Also, while the passive voice is normal for scientific writing it is not used universally, so don't feel forced into a style that you find awkward. The main thing is clarity and objectivity.

While considering style we should re-iterate what has been said elsewhere about plagiarism. If you copy more than half a line directly from a source without quoting and citing it then it is considered plagiarism. If something is so good you want to cite it literally then do it like this:
Taylor provides a concise discussion of how we can quote material:

> "While considering style we should re-iterate what has been said elsewhere about plagiarism. If you copy more than half a line directly from a source without quoting and citing it then it is considered plagiarism. If something is so good you want to cite it literally then do it like this." [2]

Note that the copied material is in quotation marks AND the source is cited. Plagiarism detection tools use techniques like looking for successive words that are the same in the examined text and also occur in another text.

MSc Dissertation Preparation Tools

There are many tools to support document preparation, from LaTeX to tools built into Microsoft Word. Find out about them and use them. Spelling errors will not be acceptable if there are spelling checkers you could have used to detect them. Errors in referencing and poorly laid out graphics may be penalised where you could have used a simple tool to insert them for you.

MSc Dissertation Assessment

Your dissertation will be marked by your supervisor and by a second reader. If they disagree by more than a certain amount, a third marker will be brought in to ensure the appraisal is balanced. If it is borderline (close to an MSc with distinction mark or the lowest mark for an MSc or PG Diploma), it may also be looked at by the external examiner for the programme. So what are the assessors of your dissertation looking for? You will be given the assessment form that we use. We are looking for some or all of:

- Clear and concise presentation of work
- Demonstration of depth of technical understanding
- Coverage of related work; knowledge of the field
- Quality of any product
- Demonstration of ability to critically analyse other work and come up with original analyses and ideas
- Any contribution to knowledge.
- Evidence of initiative and perseverance
- Demonstration of professional conduct, considering ethical, social and legal issues where appropriate, and of course no evidence of plagiarism.

MSc Dissertation Submission Procedures

Students should submit an electronic copy of their MSc dissertation along with a copy of their code and associated data in accordance with procedures that will be made known to them by the academic in charge of F21MP. The dissertation will be checked for plagiarism using TurnItIn and a copy retained in the MSc project management database. This copy will normally be available for consultation by staff and students of the university and other authorised parties unless it has been agreed that the dissertation should remain confidential.

Your document should include a signed and dated declaration that the work is your own. The following form of words should be used:

> **"I <name> confirm that this work submitted for assessment is my own and is expressed in my own words. Any uses made within it of the words of other authors in any form e.g., ideas, equations, figures, text, tables, programs etc are properly acknowledged. A list of references employed is included."**

This is a serious declaration and examiners may refer any dissertations with suspected plagiarism to the University disciplinary committee. Properly acknowledging sources means quoting as well as citing the source of any copied material.

For consistency's sake you should cite the source of this absence of plagiarism declaration.

Computer Science MSc Dissertation Assessment Grading Guidelines

The below criteria are indicative of what is expected for different grades. Markers will use these criteria as a guide while also using their subject expertise and academic judgement regarding the overall quality of the work.

Grade	Guidance Notes
A+: ≥80%	Aims and objectives of project are stated and motivated both clearly and convincingly relative to state-of-the-art. The project demonstrates clear ability to formulate/construct hypotheses. A very thorough understanding and description of the subject, background material and context. Clear evidence of independent ability to find and use references and good citing and referencing. A high degree of critical appraisal and analysis. An excellent understanding and application of research methods. Quality and description of programming/implementation and/or use of data show mastery of the chosen subject (if applicable). Conclusions are clear and well supported by the content. Clear evidence of originality of thought and reasoning. Very well structured and presented. Good use of well-chosen examples. In addition, displaying an outstanding ability to comprehend the subject matter within the wider context. There should also be clear evidence of originality of thought and reasoning. Excellent presentation of the subject and background and very clear and well-considered conclusions. The highest level of structure and presentation.
A: Normally ≥70% <80%	Aims and objectives of project are stated and motivated both clearly and convincingly relative to state-of-the-art. The project demonstrates clear ability to formulate/construct hypotheses. A very thorough understanding and description of the subject, background material and context. Clear evidence of independent ability to find and use references and good citing and referencing. A high degree of critical appraisal and analysis. An excellent understanding and application of research methods. Quality and description of programming/implementation and/or use of data show mastery of the chosen subject (if applicable). Conclusions are clear and well supported by the content. Clear evidence of originality of thought and reasoning. Very well structured and presented. Good use of well-chosen examples.
B: Normally ≥60%, <70%	Aims and objectives of project are clearly stated and motivated. Project demonstrates the ability to ask the right questions and formulate/construct hypotheses to address the issues. An increasing understanding of the subject, background material and context. Some evidence of independent ability to find and use references and good level of citing and referencing. Critical appraisal and analysis is demonstrated. Good understanding and application of research methods. Quality and description of programming/implementation and/or use of data is above the basic standard (if applicable).

	Appropriate conclusions and recommendations based on the presented work. Good structure and presentation, and good choices and use of examples.
C: Normally ≥50%, <60%	Aims and objectives of project are reasonably stated and motivated. The student shows the ability to ask questions and find answers. A reasonable understanding of the subject, background material and context, suitable level of citing and referencing. A reasonable degree of analysis and critique of state-of-the-art in the context of the project's goals. Acceptable consideration of research methods. Quality and description of programming/implementation and/or use of data is adequate to good (if applicable). Conclusions are reasonably formed and recommendations are generally supported by the work undertaken. Reasonable structure and presentation, appropriate choice and use of examples.
D: Normally ≥ 40%, <50%	Does not meet MSc standard. A basic piece of work which demonstrates: Limited clarity and motivation behind the project's aims and objectives. Limited knowledge/understanding of the subject, background material and context, inadequate citing and referencing. Supported by only little analysis and critique. Poor or non-existent consideration of research methods. Only basic or incomplete implementation (if applicable). Identifies the basic issues, but conclusions are not supported. Meets the basic requirement for structure and presentation.
E: Normally ≥ 30%, < 40%	Poorly stated, explained, or motivated aims and objectives. Very limited knowledge of the background material and context, inadequate citing and referencing. Little critical analysis of state-of-the-art in the context of the project's goals. Very poor consideration of research methods. Implementation is incomplete or absent (if applicable). Inadequate discussion of the results with very poorly or unsupported conclusions Very poorly structured and presented.
F: Normally <30%	As above, but one or more of the above listed components is missing, i.e. the dissertation shows: No evidence of knowledge of the background material and context, no proper citing and referencing or No critical analysis of state-of-the-art in the context of the project's goals or No consideration of research methods or No implementation (if applicable) or No discussion of the results with supported conclusions.

All Dissertations must be conducted in an ethical manner and be ethically approved, and must cover Legal, Ethical, Professional and Social Issues arising in the project.

APPENDIX C

Assessment Methods and Procedures

Assessment Methods and Procedures

Postgraduate programmes consist of two phases:

- A *taught phase*, consisting of a set of 8 taught courses, some mandatory and some optional, defined in the programme structure, which the students will study over two semesters. Assessment of the taught phase is through a variety of methods including coursework and/or examination. Students must submit all elements of assessment before being permitted to progress.

- A *dissertation phase*, an appropriate research project and project dissertation report.

- Students will normally complete the taught phase, at which point progression to the dissertation phase is dependent on assessed performance. To progress students must meet the criteria stipulated in point 9 below in the taught material.

- Students meeting the required standards for Masters in the taught phase (set out in point 9 below) will be permitted to progress to the dissertation phase.

- Students meeting the required standards for Postgraduate Diploma and Postgraduate Certificate (set out in point 9 below) in the taught phase, but not meeting the Masters standard, will not be permitted to progress to the dissertation phase. Students may be recommended to graduate with a Postgraduate Diploma or a Postgraduate Certificate at this point.

- Students failing to meet the required standards for Postgraduate Diploma and Postgraduate Certificate (set out in point 9 below) in coursework and examination in the taught phase will not be permitted to progress to the dissertation phase, nor will they be eligible for any award.

- Any student will be able to retake the assessment of up to a maximum of 3 courses at the next opportunity, subject to payment of the appropriate fees to the University, and may be required to do so to obtain the necessary credits for completion of their programme or for progression. Students may only resit courses for which their grade is E or F although they may exceptionally resit ones graded at D if that is necessary to get their taught average high enough to be able to progress. The method of reassessment for each course is specified in the appropriate course descriptor.

- In any circumstance which it deems to be exceptional the Exam Board has the discretion to permit student progress or award, irrespective of student performance against required standards and policies.

Award and Progression Rules

1. To obtain an MSc Degree, candidates must gain 180 credits and must satisfy the examiners by achieving the required standards (set out in point 9 below) in two components:
   - Assessed taught material
   - Dissertation (set out in point 9 below)

2. To obtain a Postgraduate Diploma candidates must gain 120 credits and must satisfy the examiners by achieving the required standards (set out in point 9 below) in the assessed taught material.

3. To obtain a Postgraduate Certificate candidates must gain 60 credits and must satisfy the examiners by achieving the required standards (set out in point 9 below) in one component:

- Assessed taught material
- The Examiners may specify certain courses as mandatory to achieve the award of Postgraduate Certificate, to reflect the nature of the course.

4. Taught courses will be assessed by a variety of techniques appropriate to the learning outcomes of the specific course.

5. All course work must be submitted before the due date. Late submissions will only be accepted with the prior permission of the Programme Director.

6. In exceptional personal or medical circumstances students may be granted leave by the examiners to redo part or all of the assessment on one occasion only and at a date decided by the examiners, as stated in university regulations 4 and 5. This provision is in addition to the provision that students may retake assessment for courses in which they have achieved a grade less than D.

7. Dissertations must be submitted on or before the publicised submission date; dissertations submitted after that date and without the prior consent of the Programme Director may be assessed at a penalty.

8. Allowance for poor performance in or non-submission of a component on medical grounds is normally made only where supported by written testimony from a professional health practitioner. Such testimony must be lodged with the Programme Director prior to the Examination Board meeting.

9. The level of achievement expected in each component is an average of:
   - 40% for the Postgraduate Diploma and Certificate
   - 50% for the MSc Degree

   MSc candidates displaying exceptional merit by obtaining a credit weighted average of 70% or more (at the first attempt) over 8 courses at grades A-C and the dissertation at grade A may be recommended for the award of MSc with Distinction. Postgraduate Diploma candidates displaying exceptional merit by obtaining a credit weighted average of 70% or more (at the first attempt) over 8 courses at grades A-C may be recommended for the award of Postgraduate Diploma with Distinction. Both distinction awards are at the discretion of the Board of Examiners.

Required Standards
Candidates must achieve the following minimum levels of performance in:

Assessed Taught Material
- A credit weighted average across the 8 courses of 50% or better for Masters, with F21RP Research Methods at 45% or above and all others at grade D or above.
- A credit weighted average across the 8 courses of 40% or better for Postgraduate Diploma (120 credits) or a credit weighted average across 4 courses of 40% or better for Postgraduate Certificate (60 credits), with no course returning a result of less than grade E.
- All elements of assessment for each course must be completed to a satisfactory level (grade E)

Dissertation
- An average of 50% or better for Masters

Notes:
Exam scripts, coursework and dissertations could be seen by third parties for quality assurance purposes – e.g. External Examiners.

PART B: UNIVERSITY INFORMATION

The Academic Registry is responsible for producing Part B of the handbook to provide information and assistance on University policies and support services.

Please note that the following sections are standard sources of information provided to all students. However, certain aspects are programme-specific and you should refer to Part A where directed. Students are advised that the University will make changes to study programmes and progression requirements from time to time in accordance with strategic developments and it is therefore important to ensure that you check the most recent version of the handbook for up-to-date information.

B1. Our Values

At Heriot-Watt, we have an established set of values that help up to nurture innovation and leadership and show our commitment to continuous development in all our activities. They are:

- Value and Respecting Everyone
- Pursuing Excellence
- Pride and Belonging
- Shaping the Future
- Outward Looking

Find out more about the Heriot-Watt values and what they mean to us.

B2. Student Learning Code of Practice

The Student Learning Code of Practice outlines information about the University, its culture, policies, regulations and the expectation for students and staff. Please familiarise yourself with the relevant Code that is located within the Learning and Teaching Policy Bank.

B3. University Policies and Support Services

Heriot-Watt University has a detailed set of rules that governs the operation and management of University business. These are referred to as Ordinances and these Ordinances are set by the Court, which is the governing body of the University. The Ordinances provide a regulatory framework for corporate governance. The University Ordinances are supported by University Regulations which provide a regulatory framework for the governance of academic-related matters which staff and student must adhere to for all academic matters. Wherever practicable, University policy is designed to include all members of the University's community, both within and outwith the main campus environments.

Read more about the University Policies, Ordinances and Regulations.

As part of your University enrolment, you signed the Student Declaration and agreed to abide by the regulations of the University and conform to its policies, procedures, ordinances and regulations that underpin the Ordinances and Regulations. During your time at Heriot-Watt, the following policies, procedures, reference information and support services may be relevant and useful guidance for you.

B4. Your Student Portal

The Student Portal brings together your services and relevant information in one place. Below is a summary of the services available to you via the portal:

- Office 365 suite: through single sign-on, all of your Office 365 services will be accessible through the Portal.
- Library: whether you want to search for books or view your loans & reservations, the Portal allows you to do this on your phone or desktop.
- Vision: your Portal will present you with announcements and tasks related to this course.
- Student Information: all university-level regulations and policies relating to your studies can be found on the Portal.
- Campus and School News: the Portal enables the University to promote events and experiences which will help you develop your skills.
- Personalised: You can hide, add and move tiles on your dashboard.
- AskHWU: You can find everything you need to help you navigate your time at HWU though the new AskHWU search tile. Ask questions of the University and enquire directly with members of staff to get information about exams, enrolment, careers, wellbeing services and much more.

You can access your student portal here.

B5. Quick Finder Guide to Academic and Support Services

The following provides an A-Z guide on the academic and support services available to you during your studies.

By clicking on the subject heading you will link to the relevant information in the student portal/website. Please ensure that you check the portal/web at the regular times throughout the year for the most up-to-date information:

A	• Academic Appeals • Academic Registry • Accommodation Services: ➢ Accommodation (Dubai Campus) ➢ Accommodation (Edinburgh Campus) ➢ Accommodation (Malaysia Campus) ➢ Accommodation (Orkney Campus) ➢ Accommodation (Scottish Borders Campus) • Alumni • Amendment to Enrolment • Assessment ➢ Feedback on Assessment ➢ Assessment Results • Assistive Software • Attendance & Absence
C	• Care Leavers • Career Mentoring • Careers Service • Change of Address • Complaints • Counselling
D	• Data Protection (or email foi@hw.ac.uk)

	• Disability Support • Discipline • Discretionary Credits (please refer to the appropriate Regulation(s) for your level of study)
E	• Email • Enrolment • Equality and Diversity Services • Erasmus+ • Exchanges • Examinations & Examination Diets ➢ Exam Diets ➢ Exam Conduct and Identity Checks ➢ Exams in Different Time Zones ➢ Exam Timetables • Exit Awards • External Examiners Information
F	• Failing a Course • Faith and Belief: ➢ Edinburgh Campus ➢ Dubai Campus ➢ Malaysia Campus • Financial Services
G	• Go Global • Guide to Student Life • New Student Information: ➢ Edinburgh and Scottish Borders Campuses available here ➢ Dubai Campus available here ➢ Malaysia Campus available here • Graduate Attributes • Graduation
H	• Harassment and Bullying • Heriot-Watt Assessment & Progression System (HAPS) • Health and Wellbeing
I	• Ill Health & Mitigating Circumstances • Information Services (Library & IT) guides • IT Essentials • Inter-Campus Transfer • Intermediate Awards • International Student Support
L	• Learning and Teaching Matters • Library Essentials • Library Resources for your Subject
M	• Maternity and Paternity
O	• Oriam (Scotland's Sport Performance Centre)
P	• People Finder

	• Periods of Study (please refer to the appropriate Regulation(s) for your level of study) • Personal Tutors • Plagiarism
R	• Re-Assessment • Requirements for Awards (please refer to the appropriate Regulation(s) for your level of study) • Recognition of Prior Learning & Credit Transfer
S	• Sexual Misconduct • Skills Development • Sport and Exercise (Edinburgh campus) • Student Council (Dubai Campus) • Student Feedback • Student Fees, Funding and Additional Charges • Student Policies and Guidance • Student Service Centre: ➢ Dubai Campus (please contact dubaistudentservices@hw.ac.uk) ➢ Edinburgh Campus ➢ Malaysia Campus • Student Services • Student Support Services • Student Surveys • Study Spaces • Student Union (Edinburgh, Orkney and Scottish Borders Campuses) • Student Wellbeing Services • Students with Caring Responsibilities
T	• Teaching Timetables • Temporary Suspension of Studies • Thinking of Leaving
U	• Use of Calculators in Examinations • Use of Dictionaries in Examinations
V	• Virtual Learning Environment (Vision) • Visas & Immigration

STUDENT GUIDE TO PLAGIARISM [1]

Plagiarism is intellectual theft and is a major offence which the University takes seriously in all cases. Students must therefore avoid committing acts of plagiarism by following these guidelines and speaking to academic staff if they are uncertain about what plagiarism means. Those who are found to have plagiarised will be subject to the University's disciplinary procedures, which may result in penalties ranging from the deduction of credits and modules already achieved by students to compulsory termination of studies. Students are advised to refer to Regulation 50 at http://www.hw.ac.uk/ordinances/regulations.pdf and to the Guidelines for Staff and Students on Discipline at http://www.hw.ac.uk/students/studies/examinations/plagiarism.htm for further details of how the University deals with all acts of plagiarism.

Introduction

1.1. This guide is intended to provide students at Heriot-Watt University with a clear definition of plagiarism and examples of how to avoid it.

1.2. The guide may also be of use to members of staff who seek to advise students on the various issues outlined below.

Definition

1.3. Plagiarism involves the act of taking the ideas, writings or inventions of another person and using these as if they were one's own, whether intentionally or not. Plagiarism occurs where there is no acknowledgement that the writings or ideas belong to or have come from another source.

1.4. Most academic writing involves building on the work of others and this is acceptable as long as their contribution is identified and fully acknowledged. It is not wrong in itself to use the ideas, writings or inventions of others, provided that whoever does so is honest about acknowledging the source of that information. Many aspects of plagiarism can be simply avoided through proper referencing. However, plagiarism extends beyond minor errors in referencing the work of others and also includes the reproduction of an entire paper or passage of work or of the ideas and views contained in such pieces of work.

Good Practice

1.5. Academic work is almost always drawn from other published information supplemented by the writer's own ideas, results or findings. Thus drawing from other work is entirely acceptable, but it is unacceptable not to acknowledge such work. Conventions or methods for making acknowledgements can vary slightly from subject to subject, and students should seek the advice of staff in their own School about ways of doing this. Generally, referencing systems fall into the Harvard (where the text citation is by author and date) and numeric (where the text citation is by using a number). Both systems refer readers to a list at the end of the piece of work where sufficient information is provided to enable the reader to locate the source for themselves.

1.6. When a student undertakes a piece of work that involves drawing on the writings or ideas of others, they must ensure that they acknowledge each contribution in the following manner:

[1] The author acknowledges the following sources of information used in preparing this guide to Plagiarism:
"Plagiarism – A Good Practice Guide", Carroll, J and Appleton, J (2001) and various extracts from Student/Course Handbooks 2004/2005, Schools at Heriot-Watt University

- **Citations**: when a direct quotation, a figure, a general idea or other piece of information is taken from another source, the work and its source must be acknowledged and identified where it occurs in the text;

- **Quotations**: inverted commas must always be used to identify direct quotations, and the source of the quotation must be cited;

- **References**: the full details of all references and other sources must be listed in a section at the end of any piece of work, such as an essay, together with the full publication details. This is normally referred to as a "List of References" and it must include details of any and all sources of information that the student has referred to in producing their work. (This is slightly different to a Bibliography, which may also contain references and sources which, although not directly referred to in your work, you consulted in producing your work).

1.7. Students may wish to refer to the following examples which illustrate the basic principles of plagiarism and how students might avoid it in their work by using some very simple techniques:

1.7.1. Example 1: A Clear Case of Plagiarism

Examine the following example in which a student has simply inserted a passage of text (*in italics)* into their work directly from a book they have read:

> University and college managers should consider implementing strategic frameworks if they wish to embrace good management standards. *One of the key problems in setting a strategic framework for a college or university is that the individual institution has both positive and negative constraints placed upon its freedom of action.* Managers are employed to resolve these issues effectively.

This is an example of bad practice as the student makes no attempt to distinguish the passage they have inserted from their own work. Thus, this constitutes a clear case of plagiarism. Simply changing a few key words in such a passage of text (e.g. replace '*problems'* with '*difficulties'*) does not make it the student's work and it is still considered to be an act of plagiarism.

1.7.2. Common Mistakes

Students may also find the following examples[2] of common plagiarism mistakes made by other students useful when reflecting on their own work:

- "I thought it would be okay as long as I included the source in my bibliography" [without indicating a quotation had been used in the text]
- "I made lots of notes for my essay and couldn't remember where I found the information"
- "I thought it would be okay to use material that I had purchased online"
- "I thought it would be okay to copy the text if I changed some of the words into my own"
- "I thought that plagiarism only applied to essays, I didn't know that it also applies to oral presentations/group projects etc"
- "I thought it would be okay just to use my tutor's notes"
- "I didn't think that you needed to reference material found on the web"
- "I left it too late and just didn't have time to reference my sources"

[2] Extract from 'Plagiarism at the University of Essex' advice copyrighted and published by the Learning, Teaching and Quality Unit at the University of Essex (http://www.essex.ac.uk/plagiarism/reasons.html), reproduced with kind permission.

None of the above are acceptable reasons for failing to acknowledge the use of others' work and thereby constitute plagiarism.

1.8. What follows are examples of the measures that students should employ in order to correctly cite the words, thought or ideas of others that have influenced their work:

1.8.1. Example 2: Quoting the work of others

If a student wishes to cite a passage of text in order to support their own work, the correct way of doing so is to use quotation marks (e.g. " ") to show that the passage is someone else's work, as follows:

"One of the key problems in setting a strategic framework for a college or university is that the individual institution has both positive and negative constraints placed upon its freedom of action".

1.8.2. Example 3: Referencing the work of others

In addition to using quotation marks as above, students must also use a text citation. If the work being cited is a book, page numbers would also normally be required. Thus, using the Harvard system for a book:

"One of the key problems in setting a strategic framework for a college or university is that the individual institution has both positive and negative constraints placed upon its freedom of action" (Jones, 2001, p121).

The same reference could also be made to a book using the numeric system:

"One of the key problems in setting a strategic framework for a college or university is that the individual institution has both positive and negative constraints placed upon its freedom of action" (Ref.1, p121).

More often, a piece of work will have multiple references and this serves to show an examiner that the student is drawing from a number of sources. For example, articles by Brown and by Smith may be cited as follows in the Harvard system

"It has been asserted that Higher Education in the United Kingdom continued to be poorly funded during the 1980's [Brown, 1991]*, whereas more modern writers* [Smith, 2002] *argue that the HE sector actually received, in real terms, more funding during this period than the thirty year period immediately preceding it".*

or as follows using the numeric system:

"It has been asserted that Higher Education in the United Kingdom continued to be poorly funded during the 1980's [Ref 1]*, whereas more modern writers* [Ref 2] *argue that the HE sector actually received, in real terms, more funding during this period than the thirty year period immediately preceding it".*

1.8.3. Example 4: Use of reference lists

Whichever system is used, a list must be included at the end, which allows the reader to locate the works cited for themselves. The Internet is also an increasingly popular source of information for students and details must again be provided. You should adhere to the following guidelines in all cases where you reference the work of others:

If the source is a book, the required information is as follows:

- Author's name(s)
- Year of Publication
- Title of Book
- Place of Publication
- Publishers Name
- All Page Numbers cited
- Edition (if more than one, e.g. 3rd edition, 2001)

If the source is an article in a journal or periodical, the required information is as follows:

- Author's name(s)
- Year of Publication
- Title of Journal
- Volume and part number
- Page numbers for the article

If the source is from the Internet, the required information is as follows:

- Author's or Institution's name ("Anon", if not known)
- Title of Document
- Date last accessed by student
- Full URL (e.g. http://www.lib.utk.edu/instruction/plagiarism/)
- Affiliation of author, if given (e.g. University of Tennessee)

The way in which the information is organised can vary, and there are some types of work (for example edited volumes and conference proceedings) where the required information is slightly different. Essentially, though, it is your responsibility to make it clear where you are citing references within your work and what the source is within your reference list. **Failure to do so is an act of plagiarism.**

1.9. Students are encouraged to use a style of acknowledgement that is appropriate to their own academic discipline and should seek advice from their personal tutor, course leader or other appropriate member of academic staff. There are also many reference sources available in the University Library which will provide useful guidance on referencing styles.

Managing Plagiarism

1.10. Students, supervisors and institutions have a joint role in ensuring that plagiarism is avoided in all areas of academic activity. Each role is outlined below as follows:

How you can ensure that you avoid plagiarism in your work:

- Take responsibility for applying the above principles of best practice and integrity within all of your work
- Be aware that your written work will be checked for plagiarism and that all incidents of plagiarism, if found, are likely to result in severe disciplinary action by the University. The standard penalty is to annul all assessments taken in the same diet of examinations (for details please refer to Regulation 50 at https://www.hw.ac.uk/about/profile/governance/ordinances-regulations.htm and to the

Guidelines for Staff and Students on Discipline at http://www.hw.ac.uk/students/studies/record/discipline.htm).

How your School will help you to avoid plagiarism:

- Highlight written guidance on how you can avoid plagiarism and provide you with supplementary, verbal guidance wherever appropriate
- Regularly check student work to ensure that plagiarism has not taken place. This may involve both manual and electronic methods of checking. A number of plagiarism detection packages are in use at Heriot-Watt University, one example being the Joint Information Systems Committee (JISC) "TurnitIn" plagiarism detection software.
- Alert you to the procedures that will apply should you be found to have committed or be suspected of having committed an act of plagiarism and explain how further action will be taken in accordance with University policy and procedures.

How the University will endeavour to reduce student plagiarism:

- Provide clear written guidance on what constitutes plagiarism and how to avoid it directly to your School and to you
- Alert you and staff in your School to the penalties employed when dealing with plagiarism cases
- Take steps to ensure that a consistent approach is applied when dealing with cases of suspected plagiarism across the institution
- Take the issue of academic dishonesty very seriously and routinely investigate cases where students have plagiarised and apply appropriate penalties in all proven cases.