HERIOT WATT UNIVERSITY

School of Mathematical & Computer Sciences

Postgraduate Programme Handbook

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

Edinburgh Campus

2016 – 2017

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Summary of Key Information

Key Personnel

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Dr Tessa Berg	T.Berg	EM G.35	8223
Dr Diana S Bental	D.S.Bental	EM 1.67	4196
Dr Frank Broz	F.Broz	EM 1.46	3430
Prof Albert Burger	A.G.Burger	EM G.36	3428
Prof Mike Chantler	M.J.Chantler	EM 1.48	3352
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Dr Lilia Georgieva	L.Georgieva	EM G.54	8159
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Dr Stefano Padilla	S.Padilla	EM 1.38	4166
Dr Ron Petrick	R.Petrick	EM 1.05	3943
Dr Verena Rieser	V.T.Rieser	EM 1.36	4129
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Shahreza Mohammadi	R.Mohammadi	EM 1.77	3289	C11PA

MSc Calendar – 2016/17

2016/17 dates	Activity
5 - 9 September 2016	Welcome Week
12 September – 2 December 2016	Semester 1 teaching
5 – 16 December 2016	Semester 1 exams
19 December 2016 – 6 January 2017	Semester 1 break
9 January – 31 March 2017	Semester 2 teaching
3 – 21 April 2017 (Easter: 16 April)	Semester 2 break
24 April – 5 May 2017	Semester 2 exams
8 May – 18 August 2017	Dissertation work / Revision
24 August 2017	MSc Poster Day

20 – 23 June 2017 (Edinburgh Campus)	Graduations
3 – 11 August 2017	Resits
16 – 17 November 2017	Graduations

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

Important information is also contained in the School Postgraduate Handbook which can be found at: http://www.macs.hw.ac.uk/students/wp-content/uploads/PG_SchoolHandbook.pdf

Information about our Information Services can be found at: http://www.hw.ac.uk/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 at the time of printing. Unforeseen circumstances may necessitate changes to the procedures, curricula and syllabus described.

MSc PROGRAMMES

ARTIFICIAL INTELLIGENCE

Programme Director: Dr Verena Rieser

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 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
F21BC	Biologically inspired Computation	M	15
F29AI	Artificial intelligence & Intelligent Agents	O	15
F21DV	Data Visualisation and Analytics	O	15
F21GA	3D Graphics and Animation	O	15
F21RS	Rigorous Methods for Software Engineering	O	15
F21SF	Software Engineering Foundations	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21RO	Intelligent Robotics	M	15
F21AD	Advanced Interaction Design	O	15
F21AS	Advanced Software Engineering	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 WITH SPEECH AND MULTIMODAL INTERACTION

Programme Director: Dr Verena Rieser

The aim of this MSc programme is to give good Computer Science graduates 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			
F29AI	Artificial Intelligence & Intelligent Agents	M	15
F21DL	Data Mining & Machine Learning	M	15
F21BC	Biologically Inspired Computation	O	15
F21DV	Data Visualisation and Analytics	O	15
F21GA	3D Graphics and Animation	O	15
F21MC	Mobile Communications and Programming	O	15
F21SC	Industrial Programming	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
F21GP	Computer Games Programming	O	15
F21RO	Intelligent Robotics	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

BUSINESS INFORMATION MANAGEMENT

Programme Director: Dr Yun-Heh (Jessica) Chen Burger

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			
F21IF	Information Systems Methodologies	M	15
F21DF	Databases and Information Systems	M	15
F21DO	Design for Online Learning	O	15
F21IM	Information Technology Master Class	O	15
F21SF	Software Engineering Foundations	O	15
C11CS	Competitive Strategy	O	15
C11OH	Work, Culture and Organisations	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21DE	Digital and Knowledge Economy	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: Professor Albert Burger

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
F21IF	Information Systems Methodologies	M	15
F2IDF	Databases and Information Systems	O	15
F21MC	Mobile Communications & Programming	O	15
F21SC	Industrial Programming	O	15
F21SF	Software Engineering Foundations	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
C11PA	Project Management	M	15
F21AN	Advanced Network Security	O	15
F21BD	Big Data Management	O	15
F21AS	Advanced Software Engineering	O	15
F21DE	Digital and Knowledge Economy	O	15
F21NA	Network Applications	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

DATA SCIENCE

Programme Director: Professor Albert Burger

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
F21DV	Data Visualisation and Analytics	M	15
F21BC	Biologically Inspired Computation	O	15
F21CN	Computer Network Security	O	15
F21IF	Information Systems Methodologies	O	15
F21SF	Software Engineering Foundations	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21BD	Big Data Management	M	15
F21AS	Advanced Software Engineering	O	15
F21DP	Distributed and Parallel Technologies	O	15
F21CA	Conversational Agents and Spoken Language Processing	O	15
F21DE	Digital and Knowledge Economy	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

INFORMATION TECHNOLOGY (BUSINESS)

Programme Director: Dr Yun-Heh (Jessica) Chen Burger

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
F21DV	Data Visualisation and Analytics	O	15
F21SF	Software Engineering Foundations	O	15
C11OH	Work, Culture and Organisations	O	15
C11SP	Strategic Project Management	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21DE	Digital and Knowledge Economy	M	15
C11PA	Project Management	O	15
F21BD	Big Data Management	O	15
F21EC	E-Commerce Technology	O	15
F21NA	Network Applications	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

INFORMATION TECHNOLOGY (SOFTWARE SYSTEMS)

Programme Director: Dr Gudmund Grov

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
F21MC	Mobile Communications & Programming	O	15
F21SC	Industrial Programming	O	15
F21SF	Software Engineering Foundations	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21NA	Network Applications	M	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
F21RO	Intelligent Robotics	O	15
Semester 3 (pending successful completion of 8 taught courses)			
F21MP	MSc Project & Dissertation	M	60

NETWORK SECURITY

Programme Director: Dr Gudmund Grov

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.

Programme Structure

Course Code	Title	Mandatory/Optional	Credits
Semester 1			
F21CN	Computer Network Security	M	15
F21SC	Industrial Programming	M	15
F29DC	Data Communications and Networking	O	15
F21MC	Mobile Communications and Programming	O	15
F21RS	Rigorous Methods for Software Engineering	O	15
F21SF	Software Engineering Foundations	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 Gudmund Grov

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			
F21RS	Rigorous Methods for Software Engineering	M	15
F21IF	Information Systems Methodologies	M	15
F21GA	3D Graphics and Animation	O	15
F21BC	Biologically Inspired Computation	O	15
F21CN	Computer Network Security	O	15
F21MC	Mobile Communications & Programming	O	15
F21SC	Industrial Programming	O	15
Semester 2			
F21RP	Research Methods and Project Planning	M	15
F21AS	Advanced Software Engineering	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
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: http://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 http://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 attend the signing-in sessions in October, November, February, March, June, July and August. You must also attend the re-enrolment session in January. It is your responsibility to make sure that you attend these events. Failure to attend 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: http://www.macs.hw.ac.uk/students/cs/cs-first-year-past-exam-papers/. To access these pages from outside the university, go to http://vpn1.hw.ac.uk first and sign in with your Heriot Watt email username and password. Then enter the URL for the past papers.

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

Coursework Submission front sheets are available in the Earl Mountbatten Building **along from** the School Office (Room 1.25). The CS & IS 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.

All coursework must be submitted by 3.30pm on the deadline date unless otherwise specified by the lecturer. Coursework that is submitted late will normally be subject to a penalty. The standard penalty system is that 10% of the maximum available mark is deducted from the mark awarded for each day late. Days are counted as working days for the School Office. Any coursework submitted more than five days late will be awarded a mark of zero. A Course Leader may decide to adopt a different penalty system for a particular course. In this case the penalty system to be applied will be set out in the course documentation or in the coursework specification.

Students who have serious concerns about meeting submission dates for coursework should consult the Course Leader as soon as possible. Any extension to the submission deadline must be approved by the Course Leader, and the reason for the extension will be recorded. Applications for extensions made **after** the due submission date will not normally be approved.

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

The official mechanism for receiving all your assessment results is on-line at 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 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 late August (see dates). Students must also give a poster presentation of their work. Dissertation marks are awarded with 90% of the marks coming from the dissertation itself, and 10% of the marks coming from a poster presentation and demonstration of the work.

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 is 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.

MSc Poster Session

The poster session takes place in the week following the dissertation hand-in (see dates) All MSc students are required to create an A1 size poster and to present it in person on the MSc poster day for a scheduled period of at least one hour. This provides an opportunity for your supervisor, second reader, external sponsors, other staff and fellow students to see the tangible outcome of your year's work and provides you with the opportunity to present your work to them. In addition students may demonstrate any outcomes of their project during the presentation period. This is optional but can be advantageous to the student to ensure the second reader and their supervisor both appreciate what their project has been about. The poster presentation will be independently marked and contributes 10% to an MSc student's final dissertation mark.

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 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
- Abelon Systems Prize for the best poster relating to the Most Innovative Project (£100) – Edinburgh

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 - 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 Alistair Houstin in room EM 1.31.

Mail
Mail (internal and external) to students is delivered to pigeon holes in the Earl Mountbatten Building, outside 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: www.hw.ac.uk/chaplaincy; email: chaplaincy@hw.ac.uk*

Student Support and Accommodation *provides student counselling and welfare support. See: http://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: http://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: www.hw.ac.uk/careers 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

Semester 1

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

Course Code: **F21BC**	**Course Title:** **Biologically Inspired Computation**	**Course Co-ordinator:** **Patricia Vargas, Michael Lones, Marta Vallejo**
Pre-requisites:	F29AI Artificial Intelligence *or equivalent*	
Aims:	Traditional computation finds it either difficult or impossible to perform a certain key range of tasks associated with pattern recognition, problem solving and autonomous intelligence. Great progress towards designing software for such tasks has emerged by taking inspiration from a range of natural, mainly biological, systems. The aims of this course are to: ♦ introduce an appreciation of the former ♦ introduce the main biologically-inspired algorithms and techniques which are now commonly researched and applied ♦ establish a practical understanding of the real-world problems to which these techniques may be fruitfully be applied.	
Syllabus:	♦ Classical vs. Biologically-inspired computation, ♦ Evolutionary algorithms (basic EA design, and how they are applied to a wide range of problems) ♦ Swarm intelligence (ant colony methods, particle swarm optimisation) ♦ Neural computation (perceptrons, multilayer perceptrons, associative networks) ♦ Cellular automata	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Understanding of limitations of traditional computation. ♦ A critical understanding of a range of biologically inspired computation methods, their limitations and areas of applicability. ♦ Ability to apply one or more biologically inspired techniques in solving a practical problem.	
Learning Outcomes: **Personal Abilities:**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Identify and define approaches that can be used to apply bio-inspired methods to existing problems in optimisation and machine learning. ♦ Exercise substantial autonomy and initiative (courseworks) (PDP) ♦ Demonstrate critical reflection (courseworks) (PDP).	
Assessment Methods:	Assessment: Exam: (weighting – 50%) Coursework: (weighting – 50%)	Re-assessment: Exam: (weighting – 100%)

Course Code: F21CN	Course Title: Computer Network & Security	Course Co-ordinator: Hamish Taylor & Mike Just
Pre-requisites:	Fundamental knowledge of computer networking, formal methods & Java programming	
Aims:	♦ Impart critical understanding of key concepts, issues, theories and principles of computer network security. ♦ Develop detailed theoretical and practical knowledge of foundational issues in computer network security. ♦ Provide detailed understanding and practical experience with key services and tools used for computer network security purposes. ♦ Give practical experience of analysing requirements, designing, implementing and testing security solutions for computer network applications.	
Syllabus:	♦ Security concepts and definitions, basics of cryptography (concepts, definitions, steganography), symmetric cryptography (historical, hash functions, MACs, block and stream encryption), asymmetric cryptography (basic number theory, RSA, DH, digital signatures), cryptographic key management, operating system security (concepts, memory management, buffer overflow, race conditions, file/disk encryption), security-enhanced Linux, authentication & access control (biometrics, passwords, role- and capability-based), as well as some Linux-based security tools (e.g., GPG, openssl). ♦ Computer network security concepts, X.800 model - attacks, mechanisms, services. Computer network layers, reference model, TCP/IP and its vulnerabilities. Network service fundamentals - sockets, services, threads and their protection. Digests – MD5, symmetric ciphers, JCE. Digital signatures, public key certificates. X.509 certificates, certificate authorities and hierarchical trust models. Secure key exchange – Diffie Hellman, SSL/TLS, SSH. Applets, Java security model and tools, signing applets with CA keys. PGP public keys, OpenPGP, web of trust, network security tools - VPNs, Firewalls, Intrusion Detection Systems, malware scanners.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Detailed and critical understanding of the concepts, issues, principles and theories of computer network security ♦ Critical theoretical and detailed practical knowledge of a range of computer network security technologies as well as network security tools and services ♦ Practical experience of analysing, designing, implementing and validating solutions to computer network security challenges using common network security tools and formal methods.	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Ability to deal with complex issues and make informed judgements about network security in the absence of complete or consistent data. ♦ Exercise substantial autonomy and initiative in addressing computer network security challenges. ♦ Showing initiative and team working skills in shared computer network security application development. (PDP) ♦ Demonstrate critical reflection on network security issues. (PDP)	
Assessment Methods:	Assessment: Examination: (Weighting 60%) Coursework: (weighting – 40%)	Re-assessment: Examination (weighting –100%)

Course Code: F21DF	Course Title: Databases and Information Systems	Course Co-ordinator: Albert Burger & Lilia Georgieva
Pre-requisites:	Undergraduate experience of database technologies, at least at application level. Numerate background.	
Aims:	♦ To equip students with a detailed and critical understanding of the processes and methodologies required for the analysis, specification and design of database systems and information systems, and the inter-relationship between such systems. ♦ To enable students to develop a critical understanding of the relationship between organisations, human activity systems and information systems, and to utilise that understanding to design and develop appropriate specialised systems. ♦ To provide the students with practical experience in designing, building and using databases, and critical awareness in the development and deployment of databases and information systems within organisations**.**	
Syllabus:	♦ Introduction to Information Systems; Case Study – Sir Edward Kelly; ♦ Domain and Types of Information Systems; ♦ Databases and Database Management System Concepts; ♦ Data Modelling & Database Design; ♦ Relational Data Model ♦ SQL Language and Constructs; ♦ Database connectivity ♦ Emerging database technologies: e.g .XML, Data Warehousing, alternative database models	
Learning Outcomes: Subject Mastery	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Extensive, detailed and critical understanding of the nature, scope and boundaries of data models and database management systems, in relational and XML paradigms. ♦ Both theoretical and practical knowledge of methodologies for specification and design of databases. ♦ Skill in the use of software tools and languages for database design, development and management. ♦ A critical understanding of and practical skills in interfacing DBMS and programs ♦ A critical understanding of emerging database technologies	
Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Taking responsibility for own work, taking responsibility in the development of resources, critical reflection on development process and work undertaken by self. ♦ Critical analysis, evaluation and synthesis of current database and information system technologies leading to original and creative response to design task. ♦ Effective communication in electronic and written report form.	
Assessment Methods:	Assessment: Examination: (weighting – 80%) Coursework: (weighting – 20%)	Re-assessment: Examination (weighting –100%)

Course Code: F21DL	Course Title: Data Mining & Machine Learning	Course Co-ordinator: Diana Bental and Katya Komendantskaya
Pre-requisites:	F29AI AI and Intelligent Agents or basic knowledge of AI concepts and issues	
Aims:	To introduce students to the fundamental concepts and techniques used in data mining and machine learning. To develop a critical awareness of the appropriateness of different data mining and machine learning techniques. To provide familiarity with common applications of data mining and machine learning techniques.	
Syllabus:	**Data Mining:** Basic concepts (datasets, dealing with missing data, classification, statistics), regression analysis, cluster analysis (k-means clustering, hierarchical clustering), unsupervised learning, self-organising maps, naïve Bayes, k-nearest-neighbour methods **Machine Learning:** decision tree learning, ensemble methods (bagging and boosting, random forests), deep learning architectures, support vector machines	
Learning Outcomes: Subject Mastery	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Extensive understanding of the data mining process. ♦ Detailed understanding of the mathematical basis of machine learning. ♦ Critical awareness of the appropriateness and performance of different techniques.	
Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Rational problem identification and definition. ♦ Critical analysis and solution selection. ♦ Thorough and robust preparation of testing strategies. ♦ Reflection on system development and performance.	
Assessment Methods:	Assessment: Coursework: (weighting – 100%) (verified by short oral exam)	Re-assessment: Coursework: (weighting – 100%) (verified by short oral exam)

Course Code: F21DO	Course Title: Design for Online Learning	Course Co-ordinator: Phil Barker
Pre-requisites:	None	
Aims:	To give a critical understanding of the issues of open and online learning. To develop knowledge & understanding of the principles of online course development. To support the development of design skills relating to technical and pedagogical requirements.	
Syllabus:	♦ Theories of learning and their application in the area of online learning. ♦ Models of learning online. The "conversational framework". ♦ Computer Mediated Communication. ♦ Training Needs Analysis. ♦ Design issues, Guidelines for developers of online learning resources. ♦ Practical design and development of Online learning resources.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Critical understanding of theories of learning & principles of application. ♦ Theoretical & practical knowledge of methodologies for the analysis, design, implementation and evaluation of online learning courses. ♦ Critical awareness of the current issues in online and e-learning	
Learning Outcomes:: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Communication using computer mediated conferencing systems. (PDP) ♦ Ability to undertake Training Needs Analysis. (PDP) ♦ Ability to design & create a technology-based learning system. (PDP)	
Assessment Methods:	Assessment: Examination: (weighting – 70%) Coursework: (weighting – 30%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F21DV	Course Title: Data Visualisation and Analytics	Course Co-ordinator: Mike Chantler
Pre-requisites:	Numeracy and good programming ability.	
Aims:	To provide students with the theory, principles and tools to enable them: ♦ To create engaging and intuitive graphical and interactive applications that allow users to search, explore, reveal, partition, understand, discover and communicate the structure and information in large data sets; ♦ To convey ideas effectively, considering both aesthetic form and required functionality that will provide insights into different types of dataset (structured and unstructured); ♦ To stimulate user engagement, attention and discovery; ♦ To be able to implement interactive web-based visualisation systems and assess their effectiveness.	
Syllabus:	Overall aims: ♦ Use case scenarios (browsing, search, engagement, summarisation, brain storming) ♦ Example data sets and visualisations. ♦ Design principles and Data source types ♦ D3 JavaScript library and programming ♦ Data, information and display/infographic types (bar, pie, tree, pack, line, map) ♦ Abstraction methods including clustering, topic modelling, dimensional reduction ♦ Interaction (exploration, browsing, filtering, focussing ♦ Project requirements (D3 web application)	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ A detailed and integrated knowledge and understanding of the data visualisation and data analysis processes. ♦ Extensive knowledge of different infographic types, interactivity and design choices. ♦ Extensive knowledge of different information and data types. ♦ Demonstrate a critical awareness of the main types of information and the appropriateness and effectiveness of associated visualisation and analysis techniques. ♦ Ability to understand requirements of different user groups and be able to adapt visualisations accordingly	
Learning Outcomes:: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Rational problem identification, conceptualisation and definition. ♦ Ability to deal with complex issues and apply critical analysis and solution selection. ♦ Exercise substantial autonomy, initiative, and creativity in the application of data visualisation & analysis techniques. ♦ Demonstrate critical reflection on system development and performance (PDP). ♦ Communicate with peers, senior colleagues and specialists (PDP).	
Assessment Methods:	Assessment: Coursework: (weighting – 100%)	Re-assessment: Coursework: (weighting – 100%)

Course Code: F21GA	Course Title: 3D Graphics and Animation	Course Co-ordinator: Stefano Padilla
Pre-requisites:	Software Development skills or equivalent (object-orientated programming), and understanding of linear algebra.	
Aims:	Investigate Computer Graphics theory and develop programming skills in 2D/3D Graphics and Animation.	
Syllabus:	♦ Computer Graphics concepts and practical introduction to Graphics Programming. ♦ Vertices, triangles, meshes, display lists and models. ♦ Hierarchical modelling and scene graphs understanding and representation. ♦ 2D and 3D transformations, homogeneous co-ordinates, matrices multiplication. ♦ Model, world, camera, scene and projection spaces. ♦ Instancing and tessellation. ♦ Materials, texture mapping and shading. ♦ Lighting and global illumination models. ♦ Shadows, occlusions and reflections. ♦ Real-time and offline rendering pipelines. ♦ Basics of procedural and physical animations. ♦ Animation systems and concepts. ♦ Animation skeletons, poses, clips, skinning and blending. ♦ Tools, environments, coding practices and industrial applications. ♦ Course summary and review.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Critical evaluation of Computer Graphics concepts. ♦ Ability to critically compare and contrast core 3D elements and structures. ♦ Critical interpretation of scene graphs, hierarchical models, and spaces. ♦ Critical evaluation of transformations, modelling, and projection concepts. ♦ Critique different material, lighting and shadowing models. ♦ Interpret and implement animation concepts and systems. ♦ Ability to design, implement and justify a small-scale rendering and animation system	
Learning Outcomes:: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Ability to think, plan, and construct in three dimensions. ♦ Representation of, planning for, and solution of problems. ♦ Ability to plan, design and implement a rendering and animation system. ♦ Skills integrating graphics and animation in various industries.	
Assessment Methods:	Assessment: Class Test: (weighting – 40%) Coursework: (weighting – 60%)	Re-assessment: Coursework: (weighting – 100%)

Course Code: F21IF	Course Title: Information Systems Methodologies	Course Co-ordinator: Jenny Coady
Pre-requisites:	None	
Aims:	This course explores a range of issues concerning advanced contemporary methodological approaches to information systems development. The aim is to enable students to develop critical faculties and techniques in relation to the selection and application of these methodological approaches.	
Syllabus:	There is a growing requirement in industry for engineers and scientists with good and appropriate analytical skills when considering the development and evolution of systems, in particular information systems. This course develops further the knowledge and skills students should have already gained in the Information Systems and Software Engineering courses in topics such as: ♦ General Systems Principles; ♦ Systems Classification and Taxonomy Models; ♦ Information Systems Life Cycle and Functions; ♦ Paradigmatic Approach to Methodology Classification; ♦ Framework for Analysis and Comparison of Methodologies (NIMSAD & Fitzgerald's); ♦ Process Improvement Models;	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* This course develops further the knowledge and skills students should have already gained in the Information Systems and Software Engineering courses. It will enable students to: ♦ Determine alternative approached to gathering requirements and systems development ♦ Compare methodologies for use in organisations using a standardised Framework ♦ Rationalise systems development to prepare a more relevant system	
Learning Outcomes:: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Critical reading and reviewing works in the field ♦ Evaluating Methods under an agreed Framework ♦ Structuring an argument (PDP) ♦ Presentations of mini lectures to show understanding of the topic area (PDP) ♦ Use of VLE as a means of learning, contributing and discussing	
Assessment Methods:	Assessment: Examination: (weighting – 60%) Coursework: (weighting – 40%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F21IM	Course Title: Information Technology Master Class	Course Co-ordinator: Peter King
Pre-requisites:	None	
Aims:	♦ To introduce students to the cutting edge of research in a topic in Information Technology. ♦ To provide students with an opportunity to create and deliver a master-class on that topic to their peers.	
Syllabus:	♦ Investigate a topic proposed and supervised by an academic ♦ Develop training/teaching materials (lectures/labs etc.) ♦ Self-study	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Demonstrate advanced, critical knowledge of a specialist area of Information Technology. ♦ Apply appropriate technologies to develop and deliver learning materials on this topic. ♦ Demonstrate an awareness of current and emerging applications of, and alternatives to, the chosen topic. ♦ Provide appropriate answers to questions posed by peers on the chosen topic. ♦ Critically reflect on feedback provided by peers on the delivered learning materials.	
Learning Outcomes:: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Critically evaluate, review, analyse and organise complex, ambiguous and unreliable information sources. ♦ Develop original and creative solutions to, and judgements on, open-ended problems. ♦ Make presentations of complex material to professional audiences	
Assessment Methods:	Assessment: Coursework: (weighting – 100%)	Re-assessment: Coursework: (weighting – 100%)

Course Code: F21MC	Course Title: Mobile Communications & Programming	Course Co-ordinator: Peter King
Pre-requisites:	Knowledge of network communications and object oriented programming	
Aims:	♦ To introduce students to the particular problems of building networks which include mobile computing devices and to explain how they may be overcome using current technology ♦ To introduce students to the issues surrounding ad hoc networking and give an understanding of how these can be addressed ♦ To introduce students to programmable mobile and handheld devices ♦ To develop students' skills in developing applications for mobile and handheld devices	
Syllabus:	Fixed node IP routing - routing techniques for conventional wired networks Mobile IP routing - routing for wireless mobiles to IP Ad hoc networks and routing Security protocols - identification and authorisation, infrastructure security Small device characteristics - screen size, memory, power consumption, input mechanisms Current devices - tablet PC, mobile phone, PDA Application development environments - Java APIs, C# and .NET	
Learning Outcomes: Subject Mastery	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ To understand and apply the principles of secure, effective communication over networks including mobile elements. ♦ To be able to explain the operation of current and proposed protocols for communication over networks which include mobile elements ♦ To understand and be able to explain the issues introduced by ad-hoc networking. ♦ To have critical understanding of common ad-hoc routing protocols ♦ To explain and critically evaluate current and proposed mobile devices ♦ To design applications for mobile devices including use of wireless communications where appropriate. ♦ To program such applications using current application development environments	
Learning Outcomes:: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ To be able to select and apply suitable techniques of analysis in assessing the effectiveness of a technical solution ♦ To be able to critically review the issues of security and privacy relating to networking ♦ To be able to write good technical documents in support of problem solving within the domains of mobile networking and of mobile and handheld device solutions.	
Assessment Methods:	Assessment: Examination: (weighting – 80%) Coursework: (weighting – 20%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F21SC	Course Title: Industrial Programming	Course Co-ordinator: Hans-Wolfgang Loidl
Pre-requisites:	Programming skills in a language such as C or Java	
Aims:	♦ To develop proficiency in contemporary industrial programming languages and platforms; ♦ To enable the elaboration and combination of system components in different languages; ♦ To enable an agile and flexible response to changes in industrial practices; ♦ To enable participation by industrial practitioners to provide context and applicability.	
Syllabus:	♦ Programming in a modern general purpose language e.g. C#, C++11 ♦ Programming for concurrency using state-of-the-art libraries and language extensions ♦ Rapid prototyping in a major scripting language with associated libraries and frameworks e.g. Python, PHP, Ruby, Lua ♦ Coverage of advanced language features where languages have been met in earlier courses ♦ Foresight of emerging programming language technologies ♦ Practical experience with standard environments (Unix, Windows), virtual machines (.NET) and tools (e.g. compilers, debuggers, libraries, shell)	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Critical appreciation of role of different programming paradigms in programming/managing systems ♦ Autonomous problem analysis/solution ♦ Critical understanding of core characteristics of contemporary operating systems and virtual machines ♦ Detailed knowledge of key abstractions across programming languages ♦ Technical proficiency in advanced language techniques in different programming paradigms	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Ability to choose/deploy/combine appropriate languages, architectures and tools ♦ Ability to employ an agile approach to software development	
Assessment Methods:	Assessment: Coursework: (weighting – 100%)	Re-assessment: Coursework: (weighting –100%)

Course Code: F21SF	Course Title: Software Engineering Foundations	Course Co-ordinator: Manuel Maarek & Katrin Lohan
Pre-requisites:	Knowledge of programming, though not necessarily in Java or an object oriented language	
Aims:	♦ To equip students with an understanding of the object oriented paradigm and the process of object oriented design. ♦ To provide knowledge of simple data structures and algorithms ♦ To support the development of object oriented programs in the Java programming language.	
Syllabus:	♦ Programming in Java: Objects, classes, encapsulation, inheritance, aggregation, polymorphism, abstract classes, interfaces. Constants and variables, primitive data types, reference variables, strings, collection classes, arrays, control structures for selection and iteration ♦ Methods: Signatures, parameters, return types. I/O File handling. Exceptions. ♦ Graphical user interface design and implementation: labels, buttons, text fields, sliders, panels, frames; menus & lists; file selection; state-based design. ♦ Object-oriented design including UML notation: CRC cards, Use cases, Activity diagrams, Interaction diagrams.	
Learning Outcomes: Subject Mastery	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Knowledge and understanding of the Java programming model. ♦ Theoretical and practical knowledge of the design and implementation of object oriented solutions to problems. Skill in the use of Java programming language. ♦ Demonstration of skill in design and implementation of practical GUI based applications	
Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Critical appreciation of the object oriented approach to software engineering. ♦ Ability to develop creative solutions to complex problems using the Java programming language. ♦ Ability to critically reflect on and refine a proposed solution. ♦ Design, implement and evaluate an object oriented solution to a problem. ♦ Awareness of role of interface in mediating between user and system	
Assessment Methods:	Assessment: Examination: (weighting – 60%) Coursework: (weighting – 40%)	Re-assessment: Examination (weighting –100%)

Course Code: F21RS	Course Title: Rigorous Methods for Software Engineering	Course Co-ordinator: Andrew Ireland & Lilia Georgieva
Pre-requisites:	None.	
Aims:	To provide knowledge and understanding of tools and techniques which support rigorous software engineering.	
Syllabus:	The course addresses the challenges of engineering safe and secure software systems. It covers a range of rigorous processes and formal methods that support the development of high integrity software systems. From modelling and reasoning about designs through to code, students will experience a range of state-of-the-art static analysis tools and techniques. While theory based, the course has a strong practical element, drawing upon industrial case study material where appropriate.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ A detailed and integrated knowledge and understanding of a range of rigorous processes and formal methods that support the development of high integrity software systems. ♦ Critical understanding of the relationship between code level annotations and high-level formal specifications. ♦ Extensive knowledge of the mechanisms that underlie advanced static analysis techniques. ♦ To be able to demonstrate a critical understanding of the relationship between code level annotations and flow analysis techniques. ♦ To be able to demonstarte a critical understanding of program proof and how it can be used to provide strong formal correctness guarantees.	
Learning Outcomes:: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Conceptualize and define new abstract problems within the context of automated software development. ♦ Deal with complex issues and make informed judgements in situations in the absence of complete or consistent data. ♦ Exercise substantial autonomy, initiative and creativity in the application of software engineering techniques. ♦ Demonstrate critical reflection. (PDP) ♦ Communicate with peers, more senior colleagues and specialists. (PDP)	
Assessment Methods:	Assessment: Examination: (weighting – 60%) Coursework: (weighting – 40%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F29AI	Course Title: Artificial Intelligence & Intelligent Agents	Course Co-ordinator: Patricia Vargas & Diana Bental
Pre-requisites:	Elementary knowledge of logic at the level of undergraduate Computer Science. Knowledge of high-level programming language concepts	
Aims:	♦ To introduce the fundamental concepts and techniques of AI, including planning, search and knowledge representation ♦ To introduce the scope, subfields and applications of AI, topics to be taken from a list including natural language processing, expert systems, robots and autonomous agents, machine learning and neural networks, and vision. ♦ To develop skills in AI programming in an appropriate language	
Syllabus:	♦ Search algorithms (depth first search, breadth first search, uniform cost search, A* search) ♦ constraint satisfaction problems; ♦ games (min-max, alpha-beta pruning); ♦ logic, resolution, introductory logic programming ♦ knowledge representation – logic, rules, frames ♦ goal and data-driven reasoning ♦ practical rule-based programming ♦ Overview of main fields of AI (Vision, Learning, Knowledge Engineering) ♦ In depth view of one field of AI (e.g. Planning, Natural language) ♦ Autonomous agents ♦ Applications of AI ♦ AI programming	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Critical understanding of traditional AI problem solving and knowledge representation methods ♦ Use of knowledge representation techniques (such as predicate logic and frames). ♦ Critical understanding of different systematic and heuristic search techniques ♦ Practice in expressing problems in terms of state-space search ♦ Broad knowledge and understanding of the subfields and applications of AI, such as computer vision, machine learning and expert systems. ♦ Detailed knowledge of one subfield of AI (e.g. natural language processing, planning) and ability to apply its formalisms and representations to small problems ♦ Detailed understanding of different approaches to autonomous agent and robot architectures, and the ability to critically evaluate their advantages and disadvantages in different contexts. ♦ Practice in the implementation of simple AI systems using a suitable language	
Learning Outcomes:: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Identification, representation and solution of problems ♦ Time management and resource organization ♦ Research skills and report writing ♦ Practice in the use of ICT, numeracy and presentation skills.	
Assessment Methods:	Assessment: Examination: (weighting – 70%) Coursework: (weighting – 30%)	Re-assessment: Examination: (weighting – 100%)

Course Code: C11CS	Course Title: Competitive Strategy	Course Co-ordinator: John Sanders
Pre-requisites:	IELTS Academic English 6.5 or equivalent	
Aims:	♦ To provide students with a sound understanding of the theoretical and practical issues involved in the strategic management of organisations. ♦ To allow students to develop knowledge and skills that will be of immediate and real value in their future careers. ♦ To strategically analyse and propose solutions to business case scenarios ♦ Enhance business planning skills and strategic thinking	
Syllabus:	♦ Introduction ♦ Strategic purpose ♦ Analysing the Strategic Environment ♦ Strategic Group Mapping ♦ Porter's Five Forces Model ♦ Analysing Resources and Capabilities ♦ Value Chain Analysis ♦ Organisational design ♦ Managing change ♦ Strategy and Culture ♦ Stakeholder Behaviour ♦ Course Review	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Provide an understanding of the key elements of the strategic management process and conceptual models of analysis. ♦ Understand the dynamics of the strategic management process. ♦ Understand the importance and impact of strategic management issues for private, public and voluntary sector organisations. ♦ Understand the application of theoretical and analytical models to real life business situations through the use of case studies.	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Develop individual analytical and problem-solving skills. ♦ Develop independent and team/group-working skills. ♦ Develop communication skills. ♦ Develop presentation skills.	
Assessment Methods:	Assessment: Examination (Weighting – 50%) Coursework: (Weighting – 50%)	Re-assessment: Examination (Weighting – 100%)

Course Code: C11SP	Course Title: Strategic Project Management	Course Co-ordinator: Amos Haniff
Pre-requisites:	IELTS Academic English 6.5 or equivalent	
Aims:	♦ To develop knowledge and skills that differentiate between the management of projects, programmes and portfolios ♦ To develop the ability to translate between business strategy, strategy implementation and project management ♦ To examine the relationship between the pipeline of requirements for expansion of a business and how it should best relate to the portfolio of strategic projects. ♦ To study how this relationship can best be put into practice in terms of the Governance Regimes which describe how individuals should best interact to achieve the intended goals and what their optimum roles and responsibilities should be. ♦ To explore the current base of knowledge of leadership through projects and management by projects so as to add more precision to the term so that it can become a valuable component of business management science. ♦ To teach postgraduate students about the emerging techniques and methodologies in ways that they can contribute to that evolution. ♦ To involve business leaders so that the techniques and methodologies can be ratified as valid in a practical environment. ♦ To apply strategic planning tools	
Syllabus:	♦ Introduction to strategic project management ♦ Project initiation ♦ Project stakeholders and the management of expectations ♦ Project leadership ♦ Systems, life cycles and methodologies ♦ Alignment and integration of business, information and organisation strategies ♦ Research trends in PM ♦ The nature of Governance Regimes in business, strategy, programmes and projects ♦ Managing the investment pipeline	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Apply leadership through projects to the process of strategy development and implementation ♦ Demonstrate knowledge and understanding of the integrative nature of project management ♦ Explain the importance and complexity of a sound strategic project plan for a business. ♦ Critically analyse the options open to business executives to allow them to draw up, optimise and monitor the strategic project plan. ♦ Determine suitable options from a range of options for investment finance and how this can be assessed afterwards as to its effectiveness. ♦ Understand the role and their interrelationships needed in a business to allow a Governance Regime to operate and the skills and characteristics needed by individuals to fill these roles. ♦ Analyse the Information Systems Architecture and how it can be enhanced by development of the business's information systems and how this can change the way the business should operate. ♦ Discuss current research and practice in the field of Management by Projects	

Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Use a range of strategic project management tools and methods ♦ Analyse a range of project management situations and recommend suitable actions ♦ Critical assessment of previous and current practice in creating and monitoring a strategic project plan. ♦ Solve problems in the development of methodologies and techniques for balancing the requirements pipeline with the strategic project portfolio. ♦ Become skilled in searching for relevant literature. ♦ Develop team-working and communication skills with other students and with business practitioners. ♦ Develop self-awareness and self-management skills from working on research-based tasks. ♦ Learn through reflection on practice and experience.	
Assessment Methods:	Assessment: Coursework: (weighting – 100%)	Re-assessment: Coursework: (weighting – 100%)

Course Code: C11OH	Course Title: Work, Culture & Organisations	Course Co-ordinator: Robert Graham
Pre-requisites:	IELTS Academic English 6.5 or equivalent	
Aims:	The aim of the course is to introduce students to the exploration and study of a range of issues in contemporary organisational studies. The focus of the course is the origins, development and significance of schools of management thought from Scientific Management and the Human Relations School / Movement. These schools of thought have dominated management thinking for much of the last century and shaped, amongst other things, the ways in which organisations are structured, how people in organisations are managed, how people work, leadership and management styles, organisational culture and organisational identity. The course will explore several of these elements at three distinct levels, macro, meso and micro and consider the ways in which these levels are linked. The macro level considers organisations as entities with, amongst other things, purpose, mission, values, culture, identity and thus the fundamental question here is, what is an organisation? The course will examine the relationships between organisations and the external environment and the ways in which they adapt to external pressures and it will also explore internal factors such as power, politics, leadership, culture management, ethics and social responsibility. At the meso level the course will explore the concept of team or group working and critically consider teams as a form of work design. At this level the course will examine intra and extra group conflict, forms of group conflict and the ways in which these conflicts impact upon individual, team and organisational performance. The course will consider the extent to which organisational and individual objectives can be reconciled and the ways in which the conflicts that emerge from, and through, the employment relationship are managed. Consequently, students will examine management techniques such as Human Resource Management, Performance Management, Reward Management, work / job design and team-working and consider the extent to which these reflect and reinforce the organisation's culture. At the individual or micro level, the course will examine ways in which individuals find meaning at work, what work means to people and the ways in which it frames people's sense of identity.	
Syllabus:	♦ The contribution to contemporary organisational studies of both Scientific Management and the Human Relations School / Movement. ♦ The organisation and the external environment. ♦ Organisational Identity and Image ♦ Power, politics and influence in organisations, their sources, how they are employed and controlled, and the ethics of organisational power. ♦ Approaches to leadership including transactional, transformational, and ethical leadership. ♦ Group dynamics, the roles people play in groups, group norms, and group decision-making, the causes and management of conflict within organisations. ♦ Human Resource Management with particular emphasis on performance management, reward management and a consideration of the extent to which these are deployed to reflect and reinforce an organisation's culture. ♦ Meaning at work and what this means to different generational groups. ♦ Understanding the importance of organisation culture, how it develops and is maintained, international differences in organisational culture, and how culture can be an aid or a barrier to organisational change and development ♦ An exploration of contemporary issues in organisational theory and practice including generational diversity, meaning at work, international dimensions of	

	leadership and management styles, cultural management, ethics, corporate social responsibility and employer branding.	
Learning Outcomes: Subject Mastery	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Understand the importance of organisational studies, the boundaries of the topic, the terminology and conventions. ♦ Critically understand several theories and concepts of organisational studies and current issues in the topic. ♦ Develop original and creative responses to the problems facing managers and employees at work. ♦ Deal with complex issues and make judgements where information is incomplete. ♦ Critically review, consolidate and extend knowledge of the topic.	
Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Communicate aspects of the topic to various audiences. ♦ Communicate aspects of the topic with peers, senior colleagues and specialists. ♦ Use appropriate software. ♦ Evaluate relevant numerical and graphical data. ♦ Know what 'people' challenges face managers at work, and how the manager can attempt to solve these challenges. ♦ Understand the different research methods used in organisational studies. ♦ Offer practical solutions in problem solving through analysis and discussion. ♦ Use the WWW to determine scholarship in organisational studies, and use VLE to communicate with colleagues. ♦ Examine the findings of researchers in organisational studies. ♦ Deal with complex ethical and professional issues in organisational studies. ♦ Work independently and as a team player.	
Assessment Methods:	Assessment: Examination (Weighting – 50%) Coursework: (Weighting – 50%)	Re-assessment: Examination (Weighting – 100%)

Course Descriptors

Semester 2

Course Code: F21AN	Course Title: Advanced Network Security	Course Co-ordinator: Mike Just
Pre-requisites:	Good understanding of fundamental computer security topics such as might be obtained by taking F21CN Computer Network Security.	
Aims:	♦ Improve students' critical analysis skills in computer network security and allow them to identify network security threats in a systematic way. ♦ Provide the student with in-depth understanding of penetration testing concepts and methodologies. ♦ Give practical experience of exploiting vulnerabilities in common computer system architectures. ♦ Impart a deep understanding of common techniques to implement countermeasures.	
Syllabus:	♦ Internet Security: review of some TCP/IP stack Protocols and their known vulnerabilities. ♦ Wireless Security: Wired Equivalent Privacy (WEP) vulnerabilities, Wireless Protected Access (WPA) and IEEE802.11i ♦ ISO27001: Information Security Management. Security Policy, Organisational Security, Asset Classification and Control, Personal Security, Physical and Environmental Security, Communications and Operations Security, Access Control, System Development and Maintenance, Business Continuity Management, and Compliance. ♦ Penetration testing: penetration testing process: Reconnaissance, Scanning, Gaining access, Maintaining access, and Covering tracks. ♦ Digital Forensics: introduction, EnCase and open source tools. ♦ Privacy and P3P.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* At the end of this course, the students will be able to: ♦ Identify and explain vulnerabilities of network protocols. ♦ Design and implement countermeasures to protect a network from unauthorised network access. ♦ Identify threats and implement measures to protect against threats in wireless networks. ♦ Test and evaluate the security of an IT infrastructure.	
Learning Outcomes: **Personal Abilities:**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Ability to critically appraise the security of an IT infrastructure. ♦ Showing teamwork skills and being an effective member of a penetration testing team. ♦ Develop a set of ethical best practices needed for a security career. ♦ Ability to make decisions regarding how to secure a system in absence of a complete picture of its configuration.	
Assessment Methods:	Assessment: Exam: (weighting – 60%) Coursework: (weighting – 40%)	Re-assessment: Exam: (weighting – 100%)

Course Code: F21RP	Course Title: Research Methods & Project Planning	Course Co-ordinator: Oliver Lemon
Pre-requisites:	None.	
Aims:	To enable students to develop skills in critical thinking, research planning, academic writing and experimental design appropriate for a post-graduate programme. To enable students to gain skills in project planning and an awareness of legal, social and professional issues relevant for IT professionals.	
Syllabus:	Research aims and objectives, literature search, critical analysis and review. Technical writing. Project planning, testing, risk analysis, requirements and design. Human factors in software development. Experimental design and software evaluation. Professional standards. Legal, social, ethical and professional issues in IT.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Ability to write literature review which critically evaluates research and current technical developments against a stated aim. ♦ Ability to search for and evaluate the value of written and online material. ♦ A critical understanding of the role of human factors in software development, and of a range of techniques for designing and evaluating with users in mind. ♦ A detailed understanding of general issues in experimental design, and how to verify a research hypothesis. ♦ An ability to apply general methodologies for project planning, and more specific methodologies related to IT projects.	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ A proper appreciation of current professional standards in software documentation, and professional legal and ethical standards relevant to the IT industry. ♦ Ability to work independently on a small project, planning and managing time. ♦ Ability to present work effectively to others, orally and written. ♦ An ability to use software tools appropriate to IT project planning and evaluation.	
Assessment Methods:	Assessment: Coursework (weighting – 100%)	Re-assessment: Coursework (weighting – 100%)

<table>
<tr><td>Course Code:
F21AD</td><td>Course Title:
Advanced Interaction Design</td><td>Course Co-ordinators:
Lynne Baillie</td></tr>
<tr><td>Pre-requisites:</td><td colspan="2">F28IN Interaction Design or equivalent</td></tr>
<tr><td>Aims:</td><td colspan="2">The course aims to give students the opportunity to develop:
♦ An extensive, detailed and critical knowledge of requirements gathering, design and evaluation techniques in interaction design.
♦ An awareness of current research and emerging issues in the field of interaction design.
♦ A range of specialised skills, and research methods involved in working with users.</td></tr>
<tr><td>Syllabus:</td><td colspan="2">Current and emerging topics in Interaction Design including: user demographics, patterns in technology adoption, interaction design lifecycles, user interface design patterns, prototyping methods, a wide range of qualitative and quantitative data gathering and analysis techniques, accessibility, and a range of research case studies covering cutting edge issues in the field</td></tr>
<tr><td>Learning Outcomes:
Subject Mastery</td><td colspan="2">Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)

Students will develop skills in the following areas:
♦ Review, critically analyse, evaluate, and synthesise of previous research projects in the field of interaction design
♦ Identify and propose innovative solutions in response to analysis of users' requirements.
♦ Make informed judgements about appropriate methodologies for developing and evaluating technologies suitable for user demographics and background experience.</td></tr>
<tr><td>Learning Outcomes::
Personal Abilities</td><td colspan="2">Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT

Students will develop skills in the following areas:
♦ Use discipline appropriate software for data analysis, prototyping and learning.
♦ Present, analyse and interpret numerical and graphical data gathered as part of evaluation studies.
♦ Communicate effectively to knowledgeable audiences by preparing formal and informal presentations and written reports.
♦ Exercise autonomy and initiative by planning and managing their own work; develop strategies for independently solving problems and taking the initiative.
♦ Take responsibility for their own and other's work by contributing effectively and conscientiously to the work of a group, actively maintaining good working relationships with group members, and leading the direction of the group where appropriate.
♦ Reflect on roles and responsibilities by critically reflecting on their own and others' roles and responsibilities.
♦ Deal with complex professional and ethical issues including working with human subjects and wider issues relating to technology in society</td></tr>
<tr><td>Assessment Methods:</td><td>Assessment:
Examination: (weighting 0%)
Coursework: (weighting – 50%)</td><td>Re-assessment:
Examination: (weighting – 100%)</td></tr>
</table>

Course Code: F21AS	Course Title: Advanced Software Engineering	Course Co-ordinator: Michael Lones and K. Komendantskaya
Pre-requisites:	Knowledge of Java programming and software engineering at undergraduate level	
Aims:	♦ To consolidate proficiency in imperative programming and software development ♦ To further develop object oriented programming and object oriented design methods ♦ To provide knowledge of simple data structures and algorithms ♦ To introduce concurrent programming techniques ♦ To instil understanding of the concepts and benefits of advanced software engineering methods ♦ To give further practical experience of the use of UML in software engineering ♦ To give practical experience of developing a substantial software engineering team project ♦ To enable the deployment of patterns in software engineering	
Syllabus:	Data structures: stacks, queues, lists, priority queues, binary trees Algorithms: searching (linear and binary) and sorting Advanced object oriented design techniques Thread based programming: thread creation and interaction, shared variables and synchronisation Methodologies in software engineering practice; Unified Modelling Language; design patterns; Project planning and management in software engineering; Comparison of agile and plan driven approaches	
Learning Outcomes: Subject Mastery	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Skill in the use of UML notation and translation of UML designs to working programs ♦ Understanding of basic data structures and algorithms and ability to critically evaluate their appropriateness and limitations for a range of moderately complex problems. ♦ Demonstration of skill in design and implementation of practical GUI based and threaded applications ♦ To demonstrate a critical understanding of modern software engineering practice and be able to evaluate the strengths and weaknesses of current software engineering methods and techniques ♦ To be able to choose a suitable software development environment and development methodology for specific software development tasks and justify the choice	
Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Appreciation of use of methodology to ground system analysis, design and development ♦ Understanding of different programming paradigms and their inter-relation ♦ Practice in working in a group, choosing a methodology, reaching a consensus, and working with others to a deadline ♦ Taking responsibility for own work, taking responsibility in the development of resources, critical reflection on development process and work undertaken by self. ♦ Effective appreciation of professional standards in modern software engineering practice. ♦ Showing initiative, creativity and team working skills in collaborative software development	

Assessment Methods:	Assessment: Examination: (weighting – 50%) Coursework: (weighting – 50%)	Re-assessment: Examination (weighting –100%)

Course Code: F21BD	Course Title: Big Data Management	Course Co-ordinator: Albert Burger & Alasdair Gray
Pre-requisites:	Academic knowledge of fundamentals of databases and logic.	
Aims:	♦ Review principle abstractions, methods and techniques for the management of large and complex data sets ("Big Data"). ♦ Develop an understanding of the foundations and tools of the Semantic Web. ♦ Enable students to appreciate critically a range of data integration solutions.	
Syllabus:	**Complex data sets:** RDF, triple stores, SPARQL, Big Data vs Smart Data vs Broad Data, NoSQL, indexing data. **Semantic Web Foundations:** RDFS, OWL, Ontologies, Reasoning, Protégé. **Data Integration:** Linked Data, Mash-ups, Ontology mapping, Data Provenance.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ A detailed and integrated knowledge and understanding of a range of data representation and data management techniques for big data sets. ♦ Critical understanding of the role of semantic web technologies in the context of big data management. ♦ Extensive knowledge of the mechanisms that underlie data integration techniques. ♦ To be able to demonstrate a critical understanding of appropriateness and effectiveness of different techniques.	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Conceptualize and define new abstract problems within the context of complex data sets. ♦ Deal with complex issues and make informed judgements about the applicability of semantic web solutions to big data questions. ♦ Exercise substantial autonomy, initiative and creativity in the application of data integration techniques. ♦ Demonstrate critical reflection. (PDP) ♦ Communicate with professional level peers, senior colleagues and specialists. (PDP)	
Assessment Methods:	Assessment: Examination: (weighting – 70%) Coursework: (weighting – 30%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F21DE	Course Title: Digital and Knowledge Economy	Course Co-ordinator: Jessica Chen--Burger
Pre-requisites:	Fundamentals of logic, grasp of computational thinking	
Aims:	♦ To provide an overview of advanced topics in Digital and Knowledge Economy, including current developments and future trends in developed economies resulting from deploying new technologies and utilising emerging knowledge. ♦ To discuss e-Business, as a new breed of modern business model that leverages technical advancements to create economic growth. ♦ To provide a high level description of business and technological issues related to Digital and Knowledge Economy. ♦ To introduce technologies and methodologies so as to provide a deep understanding of the Digital and Knowledge Economy, including business, organisational, knowledge and technology based issues. ♦ To impart rigorous technical modelling and analytical methodologies for working with complex problems in this area. ♦ To facilitate the dialogue between business and computing personnel, and translate business requirements to computing ones and vice versa. ♦ To impart deep understanding of the motivation and rationale behind the conversations between business and IT, as well as other relevant technologies and future trends - so that students can recommend them and/or participate in the decision making process for future planning.	
Syllabus:	♦ Introduction to Digital and Knowledge Economy o Introduction to Digital and Knowledge Economy o Its relevance to e-Business ♦ Topics in Digital Economy o An overview of technologies and tools for e-Business o What is a business model? What are the different types of business models? o What are the relationships between business models and innovative/disruptive technologies? o Current development and future trends in Digital and Knowledge Economy o Relevant technology offerings, e.g. Bitcoin, IBM's cloud computing platform ♦ Knowledge based technologies in Knowledge Economy o introduction to knowledge management, knowledge modelling technologies, including ontologies o Introduction to logic, Intelligent Systems and related technologies, including semantic web based technologies o Case studies of Intelligent Systems and Future trends ♦ Supply Chain Management and its relation to Digital Economy o What is SCM? What are the standard practices in SCM, e.g. SCOR? o Introduction to process modelling, business operations and SCM. o What is global SCM? Case studies, e.g. IKEA's global SCM; Current and future trends ♦ Business Intelligence: Fundamentals issues and technologies	

Learning Outcomes: Subject Mastery	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ In-depth understanding of key issues in Digital and Knowledge Economy. ♦ In-depth understanding of ontologies, conceptual and knowledge modelling technologies, in terms of design, critical evaluation and suitable practical uses. ♦ In-depth understanding of issues in intelligent systems, supply chain management and business intelligence and the roles technologies may play. ♦ In-depth understanding of issues and the motivation and rationale of business and technical problems in Digital and Knowledge Economy. ♦ Ability to select and construct conceptual models, including ontologies, and can create appropriate evaluation criteria to assess them. ♦ Ability to take self-initiatives to critically review relevant literature independently in Digital and Knowledge Economy.	
Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Extensive analytical skills in conceptual modelling methods, including ontologies, process and knowledge modelling, for business problems. ♦ Ability to make well-informed evidence-based arguments towards supporting or rejecting technologies to solve business problems. ♦ Ability to deal with complex issues and make informed judgements, e.g. about ontologies, knowledge modelling, intelligent and business systems in the absence of complete or consistent data. ♦ Exercise extensive autonomy and initiative in addressing digital and knowledge economy challenges. ♦ Demonstrate critical reflection on digital and knowledge economy. ♦ Ability to judge technology hypes and develop personal opinions on future trends.	
Assessment Methods:	Assessment: Examination: (weighting – 70%) Coursework: (weighting – 30%)	Re-assessment: Coursework: (weighting –100%)

Course Code: F21DP	Course Title: Distributed & Parallel Technologies	Course Co-ordinator: Hans Wolfgang Loidl & Bodo Scholz
Pre-requisites:	Academic knowledge of fundamentals of operating systems, computer networks and software engineering equivalent to an ordinary degree in Computer Science, basic knowledge of programming in C.	
Aims:	♦ To explore technologies and techniques underlying advanced software development for parallel and distributed systems. ♦ Review the principal abstractions, methods and techniques used in distributed and parallel programming. ♦ Develop an understanding of parallel programming on heterogeneous architectures including accelerators such as GPUs ♦ Enable students to appreciate critically a range of distributed and parallel computing technologies	
Syllabus:	Foundations of sequential and parallel programming; the role of sequential host languages in the context of distributed and parallel technologies. Distributed Technologies: Distribution concepts; low-level, mid-level and high-level distributed technologies; emerging distribution and coordination technologies. Parallel Technologies: Design of parallel systems, parallel performance analysis; programming heterogeneous systems; practical imperative parallel programming; practical declarative parallel programming	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Understanding of foundational concepts of distributed and parallel software ♦ Knowledge and application of contemporary techniques for constructing practical distributed and parallel systems using both declarative and imperative languages ♦ Parallel performance tuning using appropriate tools and methodologies ♦ Understand the role of control and data abstraction in software design and implementation ♦ Appreciation of relationship between imperative and declarative models of parallelism	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Critically analyse parallel and distributed problems. ♦ Generate, interpret and evaluate parallel performance graphs ♦ Develop original and creative parallel problem solutions ♦ Showing initiative, creativity and team working skills in shared distributed and parallel application development. ♦ Demonstrate critical reflection, e.g. understanding of applicability of, and limitations to, parallel and distributed systems	
Assessment Methods:	Assessment: Examination: (weighting – 60%) Coursework: (weighting – 40%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F21EC	Course Title: E-Commerce Technology	Course Co-ordinator: Santy Chumbe and Jessica Chen-Burger
Pre-requisites:	None	
Aims:	♦ To impart an understanding of e-Commerce technology and of how Information Systems play a fundamental role in shaping e-Commerce; ♦ To put e-Commerce technologies in a structural framework, show how they support e-Commerce operations, provide technical know-how for implementing e-Commerce platforms and analytical skills to examine the technical aspects of e-Commerce ♦ To show how marketing strategies in e-Commerce enable effective B2C relationships; ♦ To introduce practical aspects in implementing and managing e-commerce websites; ♦ To provide a description of technological challenges and innovations in e-Commerce; ♦ To impart an understanding of the integration and the interoperability aspects of e-Commerce in the whole business system.	
Syllabus:	♦ Introduction to e-Commerce and overview of its technology ♦ Web related e-Commerce technologies: o E-Commerce workflow and transactions o WWW introduction and web architecture o Dynamic web applications (client-side and server side scripting and databases) o Advanced web technologies (AJAX, semantic web, data mining, RWD, MVC) o Service-oriented Architecture (SOA) and cloud computing o Web services and APIs ♦ Implementation and management of e-Commerce technologies o Website management issues (cybersecurity) o Mobile commerce o E-Commerce marketing models o Search engine optimisation and social networking o Recommender systems and personalization o Cloud computing deployment models for e-Commerce o E-Commerce interoperability processes as part of a business system ♦ Merchant services and payment process integration	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Recognise e-Commerce as a special type of business; while at the same time can relate its underlying business logic to that of conventional business operations, e.g. in different aspects of business systems; ♦ Has in-depth knowledge and understanding of the needs of e-Commerce and how different technologies may work together to play a crucial role in enabling and enhancing business systems to meet e-Commerce requirements; ♦ Critical understanding of the evolving methodological issues pertaining to e-Commerce system development; ♦ Critical understanding of Web related technologies that enable e-Commerce applications; ♦ Insights into the current approaches to strategically deploy B2C and B2B systems; ♦ Analytical skills and critical understanding of web technologies to represent and personalize customer transactions	

Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Can deal with complex issues and make informed judgements about the use of Web based Technologies in e-Commerce; ♦ Exercise substantial autonomy, initiative and creativity in the application of Web-based tools and services for the development of e-Commerce applications; ♦ Can communicate with peers, more senior colleagues and specialists and demonstrate critical reflection (PDP); ♦ Can independently carry out research based on literatures in the field of e-Commerce Technology ♦ Can evaluate e-Commerce technologies and propose solutions to business scenarios based on a case study	
Assessment Methods:	Assessment: Examination: (weighting – 60%) Coursework: (weighting – 40%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F21GP	Course Title: Computer Games Programming	Course Co-ordinator: Ruth Aylett & Stefano Padilla
Pre-requisites:	C++ programming skills	
Aims:	To develop programming skills and techniques specific to the area of 2D and 3D computer games	
Syllabus:	♦ Computer Games Design Concepts (Genres, Narrative and Fun). ♦ Elements of Game Design (Formal, Dramatic and System Dynamics). ♦ Character and World Design. ♦ Design Programming Patterns (Input, loops, structures, objects and optimisation). ♦ Games Creation Concepts (Conceptualisation, Prototyping, Playtesting). ♦ Game-state, simulator, renderer, (hierarchical) controllers. ♦ Tools, environments and coding practices– e.g. graphics, C++ and engines. ♦ 2D and 3D game programming techniques. ♦ Physically-based modelling, particle systems, flocking. ♦ Obstacle avoidance and path planning. ♦ Group movement. ♦ Learning and adaptation in games. ♦ Action and behaviour selection. ♦ Procedural Generation. ♦ Course summary and review.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Critical appreciation of game theory and computer games history, genres and impact ♦ Ability to critically evaluate game design concepts, elements and characters. ♦ Critical understanding of available tools and their application. ♦ Knowledge of algorithms for path planning and navigation ♦ Understanding and knowledge of physically-based modelling in games and selection of techniques. ♦ Understanding and knowledge of AI techniques in games and selection of techniques. ♦ Ability to design and implement a small-scale game using 2D and 3D tools. ♦ Practical skills in graphics and AI programming in the computer games context.	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Representation of, planning for, and solution of problems. ♦ Ability to plan, design, prototype critically evaluate and communicate a game. ♦ Ability to think and plan in three dimensions. ♦ Team working skills.	
Assessment Methods:	Assessment: Examination: (weighting – 50%) Coursework: (weighting – 50%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F21NA	Course Title: Network Applications	Course Co-ordinator: Hamish Taylor
Pre-requisites:	Reasonable software development skills in Java and basic knowledge of data communications and the web	
Aims:	♦ To impart knowledge and understanding of the theories, principles and protocols underlying the primary network applications on the Internet ♦ To develop the ability to appreciate critically the range of network application technologies and standards ♦ To develop skills in a range of the principal network technologies, to impart the main design and practical issues faced in their application, and confer the ability to select and apply relevant techniques for a given network application development problem. ♦ To have students creatively develop in teams a substantial network application involving web and application server technologies to an original design of their own	
Syllabus:	Network services – service styles and models, Internet, DNS, sockets, implementing services; e-mail - MIME, SMTP, POP, IMAP; web protocols - URIs, HTTP versions and characteristics; web content - HTML, XML, XHTML, HTML 5, forms, tables, embedded objects; CSS style properties; JavaScript – object prototypes, standalone and web client programming; DOM versions, CSS 3, DHTML, AngularJS; web server programming in Java and JavaScript - REST web services, CGI, servlets, JSP, Node.js, web frameworks; asynchronous use of HTTP - AJAX, JSON, JSONP; textual conferencing - IM, IRC, web chat via short and long polling, HTTP streaming, applet sockets and web sockets; web sessions – URL rewriting, web storage, cookies; HTTP authentication.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Extensive, detailed and critical knowledge and understanding of the theories, techniques and principles underlying the design of network applications and the range of their application ♦ Theoretical and practical knowledge of the major network application types including email, web and chat applications and services ♦ Critical awareness of protocols and standards underlying key network applications especially the web and of enabling technologies for network applications such as sockets, DNS, XML ♦ Ability to design and develop useful network applications including web, email and chat software using apt technologies and languages: HTML, XML, JavaScript, CSS, Java applets, CGI, servlets, active web server pages, REST web services etc.	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Skills in selecting, applying and evaluating apt technologies in a professional way given a problem requiring network interaction ♦ Ability to build on initial skills and knowledge by independent research using online resources ♦ Showing initiative, creativity and team working skills in shared network application development	
Assessment Methods:	Assessment: Examination: (weighting – 60%) Coursework: (weighting – 40%)	Re-assessment: Examination: (weighting – 100%)

Course Code: F21RO	Course Title: Intelligent Robotics	Course Co-ordinator: Nick Taylor, Patricia Vargas & Katrin Lohan
Pre-requisites:	F29AI Artificial Intelligence *or equivalent*	
Aims:	♦ To introduce students to concepts and techniques used in robotics and applications ranging from industrial automation to robotic companions. ♦ To understand the basic concepts used in evolutionary, swarm and other bio-inspired robotics. ♦ To understand the basic concepts used in developmental robotics and human-robot interaction. ♦ To gain exposure to the main issues involved in building intelligent robot controllers.	
Syllabus:	Fundamentals of Manipulators - Geometry, kinematics, control and programming. Basics of Mobile Robots - Mapping, path planning and navigation. Sensing Technologies - Tactile, visual, auditory and multi-modal sensing. Behaviour Based Robotics, Evolutionary, swarm and other bio-inspired robotics. Cognitive Robotics - Developmental robotics and human-robot Interaction.	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ To appreciate the basic concepts of automation and intelligent robotics. ♦ To develop detailed understanding of the geometries of industrial manipulators. ♦ To develop detailed understanding of the architectures of autonomous guided vehicles (AGVs). ♦ To develop detailed understanding of interfacing & control issues of manipulator arms and AGVs. ♦ To explore the applications and implications of automation and human-robot interaction. ♦ To appreciate the different forms and uses of various sensor technologies, including multi-modal sensing. ♦ To develop detailed understanding of the architecture of behaviour-based robotics (BBR), evolutionary robotics and swarm robotics. ♦ To explore the collaboration and ethical issues of human-robot interaction. ♦ To make informed judgements about appropriate methodologies for developing and evaluating robotics applications.	
Learning Outcomes:: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ To critically analyse various paradigms and architectures. ♦ To appreciate the real-world constraints imposed on technical skills. ♦ To offer professional insights into the financial imperatives which apply to the introduction of new technology. ♦ To offer ethical insights into the introduction of new robotics technology.	
Assessment Methods:	Assessment: Examination: (weighting – 60%) Coursework: (weighting – 40%)	Re-assessment: Examination: (weighting – 100%)

Course Code: C11PA	Course Title: Project Management	Course Co-ordinators: Amos Haniff
Pre-requisites:	IELTS Academic English 6.5 or equivalent	
Aims:	♦ To develop an appreciation of the knowledge and skills required to perform as a professional project manager ♦ To develop competence in using a generic set of quantitative and qualitative project planning and control tools and techniques. ♦ To enable recognition of the limitations and appropriateness of the varied approaches to project management ♦ To demonstrate the progression from strategy formulation to the execution of projects ♦ To provide basic training in a project scheduling software package ♦ To define the role and current issues faced by project managers in the context of project control	
Syllabus:	♦ Organisation Strategy and Project Selection ♦ Organisation and Project Structures ♦ Project Definition ♦ Estimating Project Time and Costs ♦ Developing a Project Plan ♦ Managing Risk ♦ Scheduling Resources ♦ Reducing Project Duration ♦ Progress and Performance Control ♦ Project Audit and Closure ♦ Project Management and the Future ♦ Leadership and Managing Project Teams	
Learning Outcomes: **Subject Mastery**	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Critically and effectively analyse strategic project proposals ♦ Recognise good and bad project management practices ♦ Demonstrate ability to project management an industry-based strategic project scenario ♦ Demonstrate knowledge and understanding of project planning and control tools and techniques ♦ Develop knowledge and experience of commercial project management software packages	
Learning Outcomes: **Personal Abilities**	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Demonstrate team working abilities. ♦ Demonstrate leadership skills ♦ Develop analytical and problem solving skills ♦ Develop communication and presentation skills	
Assessment Methods:	Assessment: Examination: (weighting – 50%) Coursework: (weighting – 50%)	Re-assessment: Examination: (weighting – 100%)

Semester 3

Course Code: F21MP	Course Title: Masters Project and Dissertation	Course Co-ordinator: Ekaterina (Katya) Komendantskaya
Pre-requisites:	MSc Level performance in taught courses and 45% or above in F21RP Research Methods & Project Planning	
Aims:	To provide the student with an opportunity to undertake extensive investigation of an advanced or specialised topic relating to their course. To provide the opportunity to plan and execute a significant project of research, investigation or development.	
Syllabus:	This course is preceded by the linked course on requirements analysis and design, and so focuses on implementation and evaluation of software systems, as appropriate to the specific MSc programme, typically: ♦ Implementation of a significant software system OR conduct of substantial piece of empirical research. ♦ Evaluation of software system. ♦ Critical assessment of contributions to research or effectiveness of software solution. ♦ Presentation of work.	
Learning Outcomes: Subject Mastery	*Understanding, Knowledge and Cognitive Skills; Scholarship, Enquiry and Research (Research-Informed Learning)* ♦ Critical understanding of a specialised area including principal theories and concepts. ♦ Critical knowledge and skills in the application of design, implementation and evaluation techniques.	
Learning Outcomes: Personal Abilities	*Industrial, Commercial & Professional Practice; Autonomy, Accountability & Working with Others; Communication, Numeracy & ICT* ♦ Take responsibility for own work. ♦ Communicate with peers, senior colleagues and specialists through an extensive dissertation and poster display. ♦ Develop original and creative responses. ♦ Apply critical analysis, evaluation and synthesis to advanced or specialised topics.	
Assessment Methods:	Assessment: Dissertation: (weighting – 90%) Presentation (weighting – 10%)	Re-assessment: None

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 3 main elements:

1. Literature review
2. Requirements analysis of software or experiments to be attempted
3. Project plan

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. After that they prepare an MSc poster in a one week period up until the MSc poster day at which they present their poster at a special session and give a demonstration of any practical work they have accomplished. Their posters are assessed along with their dissertations and that completes their MSc programme.

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 end of August
6. project poster presentation and demonstration one week later

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 a few cases another supervisor may be arranged instead. 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 any 7 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.

90% of the project mark comes from the assessment of the dissertation and 10% comes from the project poster.

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.

MSc Posters

All MSc students are required to prepare and present an A1 sized poster in portrait mode describing their MSc project. Typically the poster will include the MSc project's title, their name, the MSc they are enrolled on, their supervisor's name and their year of study. The poster should cover the project's aims, challenges, methods, outcomes and conclusions. It should be addressed at intelligent lay persons interested in the project's themes.

Students are normally expected to present their poster in person at the MSc Poster session that is held 1 week after the MSc dissertation submission deadline. The poster and its presentation will be marked by two academics that will include their second reader and one other. An electronic copy of this poster should also be submitted to the department by the same date. Submission procedures will be made known to students by the academic responsible for F21MP.

Guidance on developing the research poster will be given to students during F21RP Research Methods and Project Planning and by their project supervisor.

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*, consisting of two stages: an appropriate research project and project dissertation report, and a poster and demonstration-based presentation.

- 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 and the dissertation at grades 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
- The Dissertation is conducted in two stages, these being:

- Stage 1: A write up in a dissertation report (90%)
- Stage 2: A poster presentation and demonstration of the project work and results (10%)

Notes:

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