

THE COURSE:	PG Cert/ PG Dip / M Sc in Computing PG Dip/ M Sc in Computing (Communications) PG Dip/ M Sc in Computing (Web Technology) PG Dip/ M Sc in Computing (Artificial Intelligence) PG Dip/ M Sc in Computing (Health Informatics))
DURATION:	One year or three years
LOCATION:	Jordanstown
MODE:	Full-time and Part-time
SPONSORING FACULTY:	Faculty of Computing and Engineering
HEAD OF SCHOOL : RESPONSIBLE	Dr JRP Hanna (Acting Head)
CHAIRMAN OF COURSE PLANNING COMMITTEE:	Dr P C Ojha

This document © University of Ulster, 2009.

This document is protected by copyright. No part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means electronic, mechanical, photocopying or otherwise, without written permission from the University of Ulster.

The course programme described in this document is subject to continuing development. Changes may be made in accordance with procedures approved by the Senate.

University of Ulster

Faculty of Computing and Engineering

Postgraduate Diploma / Master of Science in Computing

September 2009

Content

Course Committee	iv
Section A: Introduction	A1
A1: Rationale	A2
A2: Course Description	A2
A3: Relationship with other Courses in the School	A5
Appendix A1: Representative List of M Sc Informatics and M Sc Web Information Systems Dissertations Completed in 2001-07	A6
Appendix A2: Publications and Other Significant Public Output	A8
Section B: The Programme	B1
B1: Programme Specification	
PG Cert/ PG Dip/ M Sc in Computing	B2
PG Dip/ M Sc in Computing (Communications)	B13
PG Dip/ M Sc in Computing (Web Technology)	B23
PG Dip/ M Sc in Computing (Artificial Intelligence)	B33
PG Dip/ M Sc in Computing (Health Informatics)	B43
B2: Commentary	B53
B3: Course Regulations	B61
B4: Course Structure	B71
PG Cert/ PG Dip/ M Sc in Computing	B72
PG Dip/ M Sc in Computing (Communications)	B74
PG Dip/ M Sc in Computing (Web Technology)	B76
PG Dip/ M Sc in Computing (Artificial Intelligence)	B78
PG Dip/ M Sc in Computing (Health Informatics)	B80

Content Contd.

B5: Module Descriptions	
COM872J1 Distributed Systems	B82
COM913J1 Software Processes and Process Improvement	B87
COM914J2 Reliable Software Development	B92
COM915J2 Databases for Structured & Semi-Structured Data	B97
COM916J2 Research Methods	B102
COM877J1 Mobile and Wireless Networks	B108
COM834J2 Autonomic Computing and Communications	B114
COM835J1 Advanced Web Technologies	B121
COM917J2 E-Business Innovation	B126
COM836J1 Intelligent Agents	B133
COM837J2 Applied Computational Intelligence	B137
COM838J1 Health Informatics	B144
COM725J2 Emerging Healthcare Technologies	B149
COM878J4 Dissertation	B154

Section C: Programme Management	C1
---------------------------------	----

C1: Equality of Opportunity, Admissions Policy and Special Educational Needs and Disability order (SENDO)	C2
C2: Programme Management	C3
C3: Student Support and Guidance	C8
C4: Quality Assurance and Enhancement	C10

M Sc in Computing Course Committee Membership

Dr K. Adamson

Dr J. C. Augusto

Dr L Chen

Dr D Finlay

Dr J Liu

Dr P. J. Lundy

Dr J. R. P. Hanna (Acting Head, Computing and Mathematics)

Dr. D. McFall

Prof R. J. Millar (Dean, Faculty of Computing and Engineering, Ex-officio)

Dr M. D. Mulvenna

Dr C. D. Nugent

Dr P. C. Ojha (Course Director)

Mr R. Sterritt

Dr F.G. Wilkie

Dr S. Wu

Dr J. Zheng

SECTION A: INTRODUCTION

A1: Rationale

Computers, the ubiquitous technological artefacts of our age, have revolutionised all aspects of modern life – education, business, science, medicine, communication, entertainment, to name a few. Many scientific and engineering disciplines contribute to the metamorphosis of a jumble of silicon and copper into a physical artefact that, despite exquisite engineering, is still of limited utility. Computing is the discipline which transforms the physical artefact into a usable tool of almost limitless applicability. The supreme intellectual achievement¹ and sublime engineering skill which underlie the word processor, the web browser, the e-mail client or the spreadsheet can not be overestimated. Proper understanding of the intellectual achievement that is computing can come only with years of rigorous study, and commensurate engineering skill can be developed only with equally rigorous academic training followed by years of refinement through practice and application.

While an undergraduate honours degree is an excellent start to a career in computing, possession of advanced skills is becoming ever more important in the workplace. Those with experience in industry or the further education sector need the opportunity to step outside the narrow confines of their day-to-day work and discover the advances which have been made in related areas of computing. Increasing numbers of international students, especially from developing countries where computing is a most attractive profession, are also seeking to advance their careers by postgraduate study at a UK university.

Postgraduate Certificate/ Postgraduate Diploma / M Sc in Computing and associated PG Dip/ M Sc in Computing (*with specialism*) courses aim to serve this need.

A2: Course Description

The following courses are described in this document:

- Postgraduate Certificate/ Postgraduate Diploma/ M Sc in Computing;
- Postgraduate Diploma/ M Sc in Computing (Communications);
- Postgraduate Diploma/ M Sc in Computing (Web Technology);
- Postgraduate Diploma/ M Sc in Computing (Artificial Intelligence);
- Postgraduate Diploma/ M Sc in Computing (Health Informatics).

PG Cert/ PG Dip/ M Sc in Computing is a comparatively generalist course designed to provide advanced training in software engineering and a broad sample of specialist areas. After completing four core modules in software engineering, students qualify for PG Cert; further three optional modules in specialist areas and a module in research methods qualifies for PG Dip; a deeper engagement with the subjects studied for PG Dip resulting in a dissertation qualifies for M Sc. For PG Dip in Computing (*with specialism*),

¹ A computer is the physical realisation of a subtle mathematical abstraction, the Universal Turing Machine.

students are required to take four core software engineering modules, a module in research methods, two further compulsory modules in the specialism and one optional module in another specialism; a dissertation on a topic in the specialism then qualifies for M Sc in Computing (*with specialism*).

In designing these courses the Course Committee has striven to provide a taught postgraduate course in computing and related specialist areas which would appeal to the following categories of students:

- computing professionals who are already working in industry and who wish to broaden and deepen their knowledge of theoretical and practical state-of-the-art in software engineering and related areas;
- fresh graduates of computing and closely allied programmes who wish to acquire a broader and deeper knowledge of software engineering and related areas before embarking on a career in industry or undertaking postgraduate research;
- international students who wish to advance their careers by undertaking postgraduate study in computing in a UK university;
- lecturers at tertiary educational institutions, mainly further and higher education colleges or equivalent, who wish to update their technical knowledge and skills so that they are better able to teach their own students.

The course design has been informed by two major surveys of the Northern Ireland Software Industry:

- *Northern Ireland Software Industry: The State of the Software Art*, a survey conducted by the Centre for Software Process Technologies in the second half of 2002;
- *Momentum Annual Survey 2003-04*.

The Momentum Annual Survey was a survey of broad business trends in the IT sector in Northern Ireland and did not uncover anything that could significantly inform course design. In contrast, the CSPT survey concentrated on the technical 'state of practice' in the local software industry and was very helpful in assessing the industrial relevance of the course. (Further details in section B2.6.1).

In keeping with the strong vocational ethos of the School, the courses strike a balance between the practical and the theoretical by drawing on the practical expertise and research interests of teaching staff. Most taught modules are closely aligned with the research interests of teaching staff and all require substantial practical work with recently developed tools and techniques. The M Sc dissertation requires the production of a substantial software artefact.

PG Cert/ PG Dip in Computing acquires its distinctive character through five compulsory modules. The following four,

COM872J1 Distributed Systems,

COM913J1 Software Processes and Process Improvement,
 COM914J2 Reliable Software Development and
 COM915J2 Databases for Structured and Semi-Structured Data

are designed to develop technical skills in the core areas of distributed computing, databases and software engineering as well as softer but equally vital skill in the area of process improvement. Students who complete these four modules qualify for the award of Postgraduate Certificate in Computing.

For Postgraduate Diploma in Computing, the compulsory modules are rounded off by COM916J2 Research Methods which emphasises equally the unique engineering, scientific and societal dimensions of computing and is designed to inculcate broad research skills which students will utilise in the M Sc dissertation and later professional life.

The optional modules reflect specialist interests of teaching staff and will give students an opportunity to sample a range of specialist subject areas that appeal to them. Eight optional modules -- in four specialist areas, namely Computer Communications, Web Technology, Applied Artificial Intelligence and Health Informatics -- are offered of which students are required to take three.

In addition to the five compulsory modules listed earlier, students who wish to obtain PG Dip (*with specialism*) complete two further compulsory modules in the specialism and one optional module outside the specialism (i.e. from another specialism). The specialisms and the corresponding compulsory modules are as follows:

Specialism	Compulsory Module
Communications	Mobile and Wireless Networks
	Autonomic Computing and Communications
Web Technology	Advanced Web Technologies
	E-Business Innovation
Artificial Intelligence	Intelligent Agents
	Applied Computational Intelligence
Health Informatics	Health Informatics
	Emerging Healthcare Technologies

Table B2.1 Computing specialisms and corresponding compulsory modules

On completing the taught component of the course, students commence the M Sc dissertation. Generalist M Sc in Computing students may choose a topic in any area of computing covered in taught modules whereas M Sc in Computing (*with specialism*) students must choose a topic in their specialist

area. This gives students the opportunity to integrate and extend what they have learned in the taught modules by undertaking a substantial research and software development exercise. Dissertation topics arise either from research and scholarly activities of teaching staff or from the work experience of students. A representative list of dissertations from the past seven years of predecessor courses, M Sc in Informatics M Sc in Web Information Systems, is given in Appendix A1; publications and other significant public output is listed in Appendix A2.

A3: Relationship with Other Courses in the School

The full-time undergraduate B Sc (Hons) Computing Science degree offered by the School was revised in 2008 to accommodate specialisms in several areas. In addition to programmes in Software Engineering, Information and Communication Technologies and Interactive Multimedia Design, from 2008 entry onwards, full-time students are able to enrol in the following undergraduate programmes:

- B Sc Hons Computing Science;
- B Sc Hons Computing Science (Artificial Intelligence);
- B Sc Hons Computing Science (Enterprise Technologies);
- B Sc Hons Computing Science (Healthcare Technologies);
- B Sc Hons Computing Science (Mathematical Applications);
- B Sc Hons Computing Science (Network Technologies).

The structure of PG Dip / M Sc in Computing (*with or without specialism*) closely parallels the structure of these undergraduate degrees and makes the progression from the undergraduate programme to the postgraduate programme (almost) seamless. The core area of software engineering as well as the specialist areas are covered in greater depth in the postgraduate courses.

The School also offers two complementary postgraduate courses which are designed for different constituencies:

- Postgraduate Certificate in Health Informatics;
- M Sc in eLearning: Interactive Teaching Technologies.

M Sc in eLearning: Interactive Teaching Technologies is designed to equip eLearning tutors with the necessary skills to design the curriculum and to achieve learning goals using a wide variety of delivery formats and media. It is delivered fully online through the university's Campus One. Its purpose and mode of delivery set it completely apart from other postgraduate courses.

PG Cert in Health Informatics was planned in close collaboration with Health and Social Care Services (HSC) ICT Training Group, the body responsible for ICT training in the Health service in Northern Ireland, and is targeted at HSC employees, at least in the first instance. It is anticipated that some of these students may move on to PG Dip in Computing (Health Informatics).

Appendix A1: Representative list of M Sc in Informatics and M Sc in Web Information Systems dissertations completed in 2001-07

Autonomous Pathfinding in a 3D Smart Home Simulator
Enhancing the Performance of Large Scale Recommender Algorithms
Improving Situation Diagnosis for Smart Homes
Document Management System for Medical Devices (DMS-MD)
Web-based Interactive System for Extracting Biological Features from DNA Sequences
Community-based Portal for Information Sharing and Discovery Using Collaborative Creation of Semantic Content: Combining Folksonomy with the Semantic Web
Ajax – Real Applications in the Browser?
Tools for Researching Folksonomies
Using Personalized Knowledge Portal for Information Integration and Sharing
An Evaluation of New Generation XML Enabled Databases as a Solution to Enterprise Document Management
An Assessment of the PHP Model-View-Controller Framework for Web Information Systems Development
Reflex Autonomicity in an Agent-Based Security System
An Extensible Platform for Adaptive Spoken Dialogue Applications
3D Smart Homes Simulator
Mobile Transaction Processing for Community health Workers
A Comparative Evaluation of Relational and Object-Relational Databases
A tagging Approach for Book Reviews and Quotations
Hierarchical Autonomic Communications Fault Management Simulation
Unicode Transition Mapping
Checking Behavioural Properties of Smart Homes
A Sequence Alignment System with the Smith-Waterman Algorithm
Distributed Computing System for Bioinformatics
Medical Decision Support and Notification through Portable Devices
CMMI Light Assessment Tool
Lifestyle Support through Efficient ECG Acquisition and Analysis
XML Enabled Clipboard for Inter-process Communication
An Electronic Notebook for Sequencing
Di@L-log: A Telemedicine Framework for Type 2 Diabetes Patients
Defect Analysis and Reporting Tool
XML-based System for Managing E-Learning Students
A Graphical User Interface for a Digital Signal Processing Software Tool
A Generic Tool for Aggregating Web Sourced Data

UUFIND Search Engine

Investigation of Autonomic Computing and Pulse Monitoring

Distributed Statistical Databases and Web Development

Prediction of Protein Secondary Structure Using Neural Networks

Standardising Evoked Potential Data with HL7 CDA Level 1

An Investigation into Visualising Architectural Features of Object Oriented Code Using Alternative Graphical Representations and XML

CHOICE: Customer has Choice in Internet Computing Environment

Application Integration with B2B Standards

Multimodal Clocking Station Monitoring Application

Application of Various Modelling Techniques to Analyse Housing Condition Survey Dataset

DKIT Voice Application

Online Annotation and Viewing

Appendix A2: Publications and other significant public output

M Sc dissertations in Appendix 1 have resulted in the following research papers:

Marks RM and WILKIE FG, (April 2004) "Visualising Object-Oriented Source Code Complexity using XML", 9th IEEE International Conference on Engineering of Complex Computer Systems (ICECCS 2004), Florence, Italy, 14-16 April 2004, pp161-170;

Sterritt R, Chung S, (May 2004) "Personal Autonomic Computing Self-Healing Tool", Proceedings of IEEE Workshop on the Engineering of Autonomic Systems (EASe 2004) at 11th Annual IEEE International Conference and Workshop on the Engineering of Computer Based Systems (ECBS 2004) , Brno, Czech Republic, 24-27 May, Pages 513-520.

Mulvenna, M.D., Sterritt, R., Lawrynowicz, A., Devlin, G., "Service Delivery Platforms: Servicing Real-World Mobile Ubiquitous Computing Applications", Proc. Second International Workshop on Managing Ubiquitous Communications and Services (MUCS-2004), December 2004, Dublin, Ireland

"Di@L-log: A Telemedicine Framework for Type 2 Diabetes Patients" contributed to a larger research project which won the first prize in the 2005 Investment Belfast £25K Awards.

SECTION B: THE PROGRAMME

B1: Programme Specification

UNIVERSITY OF ULSTER PROGRAMME SPECIFICATION

COURSE TITLE: PG Cert/ PG Dip/ M Sc in Computing

PLEASE NOTE: This specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he or she takes full advantage of the learning opportunities provided. More detailed information on the specific learning outcomes, content and the learning, teaching and assessment methods of each module can be found at www.infi.ulster.ac.uk/~cbdq23/admin/pgd_msc_computing.html and in the programme handbook.

1 AWARDING INSTITUTION:	UNIVERSITY OF ULSTER
2 TEACHING INSTITUTION:	UNIVERSITY OF ULSTER
3 LOCATION:	Jordanstown
4 TO BE ACCREDITED BY:	British Computer Society
5 FINAL AWARD:	M Sc in Computing
6 MODE OF ATTENDANCE:	Part-time or Full-time
7 SPECIALISMS:	Computing
8 COURSE CODE:	To be assigned
9 DATE REVISED:	2007/08

10 EDUCATIONAL AIMS OF THE COURSE

To provide graduates in the field of computer science and related disciplines with advanced knowledge of computing, the competence to apply the most recent techniques in the area and the ability to critically evaluate current research and practice:

- to enable graduates to evaluate current research in software engineering and related disciplines;
- to provide graduates already in industry with the opportunity to enhance their practice and experience with knowledge of the theory of computing;
- to make graduates familiar with best practice and state-of-the-art approaches to software engineering and related disciplines;
- to enable graduates to contribute to the management of the software engineering process in a complex environment and to evaluate its impact;
- to develop in students the ability to communicate effectively a complex argument concerning computer science;

- to have students carry out a substantial piece of work involving scholarship and critical evaluation in an area of computing and resulting in a dissertation (M Sc only).

11 MAIN LEARNING OUTCOMES

The following reference points were used to inform the development of the programme and its learning outcomes:

- the University's Vision and core strategic aims, teaching and learning strategy and policies;
- current research or other advanced scholarship carried out by academic staff;
- requirements of professional, statutory or regulatory bodies (the British Computer Society);
- national and University qualifications and credit frameworks;

The course provides opportunities for students to achieve and demonstrate the following learning.

11K SUBJECT RELATED QUALITIES

Knowledge and Understanding

Successful students will be able to:

- K1 design, build, deploy and evaluate distributed computing systems;
- K2 apply the principles and techniques for storage, manipulation and retrieval of data to practical problems;
- K3 develop robust, reliable software in a well managed engineering process;
- K4 employ a range of established and emerging technologies for building computational systems;
- K5 design and deploy a variety of architectures for computational systems.

PG Cert: K1-K3

PG Dip: K1-K5

M Sc: K1-K5

Teaching and Learning Methods: Lectures, tutorials, seminars, practical sessions, self-study, project work for dissertation (M Sc only).

Assessment Methods: Coursework assessment, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11I INTELLECTUAL QUALITIES

Successful students will be able to:

- I1 abstract and model real-world problems in terms of computer science concepts;

- I2 conceptualise original design solutions to computer science problems;
- I3 abstract and model a wide range of real-world problems in terms of computer science concepts;
- I4 conceptualise original design solutions to a wide range computer science problems;
- I5 critically evaluate and integrate the arguments of others in the area of computer science research and/or professional practice;
- I6 reason critically in the area of computer science and software engineering.

PG Cert: I1, I2

PG Dip: I3-I6

M Sc: I3-I6

Learning and Teaching Methods: Lectures, student-led seminars, practical work and self-directed learning employing research based materials.

Assessment Methods: Coursework related to case studies and projects, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11P PROFESSIONAL/PRACTICAL SKILLS

Successful students will be able to:

- P1 specify a complex computer-based system using tools and techniques from best practice in software engineering;
- P2 design, implement and evaluate software solutions to problems in their professional area of interest and in the process respond to changes in the problem area, and the software and hardware available;
- P3 write reports, using complex arguments, for various audiences, users, management, other professionals and/or the academic community;
- P4 undertake a substantial piece of work in an area at the forefront of research or practice in computer science and report on it professionally.

PG Cert: P1-P3

PG Dip: P1-P3

M Sc: P1-P4

Learning and Teaching Methods: Lectures, tutorials, problem-based seminars and practical work, coursework, project work (including literature review).

Assessment Methods: Coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

11T TRANSFERABLE SKILLS

Successful students will be able to:

- T1 structure complex ideas and convey them both orally and in writing, to a range of audiences;

- T2 apply project management techniques to a programme of work;
- T3 act ethically as a researcher and computing professional;
- T4 manage their own learning, taking responsibility for continuing professional development.

PG Cert: T1-T4

PG Dip: T1-T4

M Sc: T1-T4

Learning and Teaching Methods: Lectures, tutorials, self-directed study, seminars and practical sessions, project.

Assessment Methods: Seminars, coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

11

MODULE OUTCOME MAP: PG Cert in Computing

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	I1	I2	P1	P2	P3	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x		x	x	x		x	x
COM913J1	Software Processes and Process Improvement	7			x	x				x	x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x			x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x				x	x

MODULE OUTCOME MAP: PG Dip in Computing

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I3	I4	I5	I6	P1	P2	P3	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x	x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x	x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x			x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x				x	x
COM916J2	Research Methods	7								x	x			x	x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x	x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x				x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x	x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x	x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x					x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x	x			x
COM838J1	Health Informatics	7	x	x					x	x	x	x	x	x	x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x	x			x

MODULE OUTCOME MAP: M Sc in Computing

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I3	I4	I5	I6	P1	P2	P3	P4	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x		x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x		x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x				x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x					x	x
COM916J2	Research Methods	7								x	x			x		x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x		x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x					x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x		x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x		x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x						x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x		x			x
COM838J1	Health Informatics	7	x	x					x	x	x	x	x	x		x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x		x			x
COM878J4	Dissertation	7	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

12 STRUCTURE AND REQUIREMENTS FOR THE AWARD

This course is studied part-time over a period of three years or full-time over a period of one year. The taught component of the programme is worth 120 credit points. It comprises eight modules of study: five compulsory modules and three optional modules (each worth 15 credit points). Having completed the taught modules, students undertake a dissertation worth 60 credit points.

All modules are taught over the period of a semester of 15 weeks duration which includes the examination period. The study units within the course, both compulsory and optional, the levels at which they are studied and the credit ratings are shown below.

Students who complete the four core modules – Distributed Systems, Software Processes and Process Improvement, Reliable Software Development and Databases for Structured and Semi-Structured Data -- qualify for Postgraduate Certificate in Computing. Those who go on to complete the entire taught component of the course (i.e eight taught modules) are eligible for Postgraduate Diploma in Computing. On completion of the dissertation module, students are awarded the degree of Master of Science in Computing.

The language of instruction is English.

Module Title	Credit Level	Credit Points	Status ²	Award
Distributed Systems	7	15	C	
Software Processes and Process Improvement	7	15	C	
Reliable Software Development	7	15	C	
Databases for Structured and Semi-Structured Data	7	15	C	PG Cert
Research Methods	7	15	C	
Mobile and Wireless Networks	7	15	O	
Autonomic Computing and Communications	7	15	O	
Advanced Web Technologies	7	15	O	
E-Business Innovation	7	15	O	
Intelligent Agents	7	15	O	
Applied Computational Intelligence	7	15	O	
Health Informatics	7	15	O	
Emerging Healthcare Technologies	7	15	O	PG Dip
Dissertation	7	60	C	M Sc

² Compulsory or Optional

13 SUPPORT FOR STUDENTS AND THEIR LEARNING

Students and their learning are supported in a number of ways:

- Course handbook and a Module Handout for each module;
- Library pack and specialised introduction to electronic resources in the library;
- Extensive library and other learning resources, including on-line journals;
- Over six computer laboratories with a wide range of software;
- Intranet with a wide range of learning support material;
- CD-ROM with a wide range of software, tutorials and information resources;
- Student e-mail accounts and full access to the Internet;
- Course director acts as a personal tutor.
- Induction process
- Personal Development Planning
- Careers Development Centre
- Student Support Department
- Sport and Recreation Department
- International Office
- Student's Union
- Chaplaincy

14 CRITERIA FOR ADMISSION

Applicants must hold a degree or equivalent in Computer Science or a related discipline or demonstrate their ability to undertake the course through the accreditation of prior experiential learning.

15 EVALUATING AND IMPROVING THE QUALITY AND STANDARD OF LEARNING AND TEACHING

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards -

- Module reviews (student questionnaires and teaching team report).
- Annual course review prepared by the course director and reviewed by peers at Faculty and University level.
- External Examiner's reports.
- Consultation with the faculty's industrial liaison panel.
- University procedures for initial approval and periodic re-approval.
- Course accreditation by the British Computer Society.
- Peer teaching observations and feedback.
- Annual staff appraisals.

Committees with responsibility for monitoring and evaluating quality

- Staff Student Consultative Committee
- Course committee
- Board of Examiners
- School Board
- Faculty Academic Affairs Committee
- University Teaching and Learning Committee.

Mechanisms for gaining student feedback on the quality of their learning experience

- Staff-Student Consultative Committee
- Student representatives on School and Faculty boards
- Module evaluation questionnaires / module forum / module freeform responses
- University questionnaires on course completion
- Feed back to the Course Director in his capacity as personal tutor.

Staff development includes:

- Updating in the subject through research, scholarship and academic enterprise.
 - Consultancy

16 REGULATION OF STANDARDS

Assessment rules

- Pass mark for course, module and individual assessments = 50%.
- Full details of module assessment are set out in each module booklet.
- Students must pass the dissertation to be awarded a Master's degree.
- An average mark of 70% in the taught modules (subject to further distribution requirements given in the Course Regulations) qualifies for PG Dip with Distinction.
- An average mark of 70% in the taught modules AND dissertation (subject to further distribution requirements given in the Course Regulations) qualifies for M Sc with Distinction.

External Examiners

There is 1 external examiner for the course. External examiners are academic subject or professional experts appointed from outside the University. Their key functions are to contribute to the assurance of the standards of the award and the fair treatment of students. They are involved in the moderation and approval of assessments and the moderation of the marking undertaken by internal examiners.

17 INDICATORS OF QUALITY RELATING TO LEARNING AND TEACHING

- The predecessor course, PG Dip / M Sc in Informatics, was last accredited by the British Computer Society in October 2002 for FIVE intakes starting 2002-03. M Sc in Informatics graduates are exempt from BCS examination requirements for Professional Graduate Diploma and PGD project; holders of PG Dip in Informatics are exempt from BCS examinations for Professional Graduate Diploma.
- The contribution and commitment of school staff was commended by the Quality Assurance Agency for Higher Education (QAA) in its draft report on the institutional audit that it carried out in April 2005.
- Many school members are also members of the Higher Education Academy.
- Three school staff have received the university's Distinguished Teaching Award.
- One member of staff was the recipient of the British Computer Society's IT Professional of the Year award for 2006.
- Research Assessment Exercise rating of 4 (2001).
- External funding for learning and teaching initiatives of the order of £500,000 per annum till 2008-09. This is through the Higher Education Academy's Centre for Information and Computing Sciences which is hosted by the School of Computing and Mathematics.
- The School also hosts the Centre for Software Process Technologies with a brief to vitalise the software industry in Northern Ireland by engaging in 'applied research with commercial software development organisations to improve the efficiency, effectiveness and quality of their processes and products' (<http://www.infc.ulst.ac.uk/informatics/cspt/aboutCSPT.html>). The teaching of software engineering benefits directly from the expertise available in the centre.

**UNIVERSITY OF ULSTER
PROGRAMME SPECIFICATION**

COURSE TITLE: PG Dip/ M Sc in Computing (Communications)

PLEASE NOTE: This specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he or she takes full advantage of the learning opportunities provided. More detailed information on the specific learning outcomes, content and the learning, teaching and assessment methods of each module can be found at www.infi.ulster.ac.uk/~cbdq23/admin/pgd_msc_computing.html and in the programme handbook.

1 AWARDING INSTITUTION:	UNIVERSITY OF ULSTER
2 TEACHING INSTITUTION:	UNIVERSITY OF ULSTER
3 LOCATION:	Jordanstown
4 TO BE ACCREDITED BY:	British Computer Society
5 FINAL AWARD:	M Sc in Computing (Communications)
6 MODE OF ATTENDANCE:	Part-time or Full-time
7 SPECIALISMS:	Computing
8 COURSE CODE:	To be assigned
9 DATE REVISED:	2007/08

10 EDUCATIONAL AIMS OF THE COURSE

To provide graduates in the field of computer science and related disciplines with advanced knowledge of computing, the competence to apply the most recent techniques in the area and the ability to critically evaluate current research and practice:

- to enable graduates to evaluate current research in software engineering and related disciplines;
- to provide graduates already in industry with the opportunity to enhance their practice and experience with knowledge of the theory of computing;
- to make graduates familiar with best practice and state-of-the-art approaches to software engineering and related disciplines;
- to enable graduates to contribute to the management of the software engineering process in a complex environment and to evaluate its impact;
- to develop in students the ability to communicate effectively a complex argument concerning computer science;
- to have students carry out a substantial piece of work involving scholarship and critical evaluation in an area of computer communications and resulting in a dissertation (M Sc only).

11 MAIN LEARNING OUTCOMES

The following reference points were used to inform the development of the programme and its learning outcomes:

- the University's Vision and core strategic aims, teaching and learning strategy and policies;
- current research or other advanced scholarship carried out by academic staff;
- requirements of professional, statutory or regulatory bodies (the British Computer Society);
- national and University qualifications and credit frameworks;

The course provides opportunities for students to achieve and demonstrate the following learning.

11K SUBJECT RELATED QUALITIES

Knowledge and Understanding

Successful students will be able to:

- K1 design, build, deploy and evaluate distributed computing systems;
- K2 apply the principles and techniques for storage, manipulation and retrieval of data to practical problems;
- K3 develop robust, reliable software in a well managed engineering process;
- K4 employ a range of established and emerging technologies for building computational systems, especially for communications;
- K5 design and deploy a variety of architectures for computational systems, especially for communications.

PG Dip: K1-K5

M Sc: K1-K5

Teaching and Learning Methods: Lectures, tutorials, seminars, practical sessions, self-study, project work for dissertation (M Sc only).

Assessment Methods: Coursework assessment, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11I INTELLECTUAL QUALITIES

Successful students will be able to:

- I1 abstract and model a wide range of real-world problems in terms of computer science concepts;
- I2 conceptualise original design solutions to a wide range computer science problems;

- I3 critically evaluate and integrate the arguments of others in the area of computer science research and/or professional practice;
- I4 reason critically in the area of computer science and software engineering, especially communications.

PG Dip: I1-I4
M Sc: I1-I4

Learning and Teaching Methods: Lectures, student-led seminars, practical work and self-directed learning employing research based materials.

Assessment Methods: Coursework related to case studies and projects, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11P PROFESSIONAL/PRACTICAL SKILLS

Successful students will be able to:

- P1 specify a complex computer-based system using tools and techniques from best practice in software engineering;
- P2 design, implement and evaluate software solutions to problems in their professional area of interest and in the process respond to changes in the problem area, and the software and hardware available;
- P3 write reports, using complex arguments, for various audiences, users, management, other professionals and/or the academic community;
- P4 undertake a substantial piece of work in an area at the forefront of research or practice in computer communications and report on it professionally.

PG Dip: P1-P3
M Sc: P1-P4

Learning and Teaching Methods: Lectures, tutorials, problem-based seminars and practical work, coursework, project work (including literature review).

Assessment Methods: Coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

11T TRANSFERABLE SKILLS

Successful students will be able to:

- T1 structure complex ideas and convey them both orally and in writing, to a range of audiences;
- T2 apply project management techniques to a programme of work;
- T3 act ethically as a researcher and computing professional;
- T4 manage their own learning, taking responsibility for continuing professional development.

PG Dip: T1-T4
M Sc: T1-T4

Learning and Teaching Methods: Lectures, tutorials, self-directed study, seminars and practical sessions, project.

Assessment Methods: Seminars, coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

MODULE OUTCOME MAP: PG Dip in Computing (Communications)

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I1	I2	I3	I4	P1	P2	P3	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x	x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x	x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x			x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x				x	x
COM916J2	Research Methods	7								x	x			x	x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x	x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x				x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x	x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x	x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x					x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x	x			x
COM838J1	Health Informatics	7	x	x					x	x	x	x	x	x	x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x	x			x

MODULE OUTCOME MAP: M Sc in Computing (Communications)

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I1	I2	I3	I4	P1	P2	P3	P4	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x		x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x		x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x				x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x					x	x
COM916J2	Research Methods	7								x	x			x		x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x		x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x					x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x		x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x		x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x						x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x		x			x
COM838J1	Health Informatics	7	x	x					x	x	x	x	x	x		x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x		x			x
COM878J4	Dissertation	7	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

12 STRUCTURE AND REQUIREMENTS FOR THE AWARD

This course is studied part-time over a period of three years or full-time over a period of one year. The taught component of the programme is worth 120 credit points. It comprises eight modules of study: seven compulsory modules and one optional module (each worth 15 credit points). Having completed the taught modules, students undertake a dissertation worth 60 credit points.

All modules are taught over the period of a semester of 15 weeks duration which includes the examination period. The study units within the course, both compulsory and optional, the levels at which they are studied and the credit ratings are shown below.

Students who complete the taught component of the course satisfactorily are eligible for Postgraduate Diploma in Computing (Communications). On completion of the dissertation module, students are awarded the degree of Master of Science in Computing (Communications).

The language of instruction is English.

Module Title	Credit Level	Credit Points	Status³	Award
Distributed Systems	7	15	C	
Software Processes and Process Improvement	7	15	C	
Reliable Software Development	7	15	C	
Databases for Structured and Semi-Structured Data	7	15	C	
Research Methods	7	15	C	
Mobile and Wireless Networks	7	15	C	
Autonomic Computing and Communications	7	15	C	
Advanced Web Technologies	7	15	O	
E-Business Innovation	7	15	O	
Intelligent Agents	7	15	O	
Applied Computational Intelligence	7	15	O	
Health Informatics	7	15	O	
Emerging Healthcare Technologies	7	15	O	PG Dip
Dissertation	7	60	C	M Sc

(Normally E-Business Innovation, Applied Computational Intelligence and Emerging Healthcare Technologies are not available in this specialism.)

³ Compulsory or Optional

However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose one of these instead of a 1st semester option.)

13 SUPPORT FOR STUDENTS AND THEIR LEARNING

Students and their learning are supported in a number of ways:

- Course handbook and a Module Handout for each module;
- Library pack and specialised introduction to electronic resources in the library;
- Extensive library and other learning resources, including on-line journals;
- Over six computer laboratories with a wide range of software;
- Intranet with a wide range of learning support material;
- CD-ROM with a wide range of software, tutorials and information resources;
- Student e-mail accounts and full access to the Internet;
- Course director acts as a personal tutor.
- Induction process
- Personal Development Planning
- Careers Development Centre
- Student Support Department
- Sport and Recreation Department
- International Office
- Student's Union
- Chaplaincy

14 CRITERIA FOR ADMISSION

Applicants must hold a degree or equivalent in Computer Science or a related discipline or demonstrate their ability to undertake the course through the accreditation of prior experiential learning.

15 EVALUATING AND IMPROVING THE QUALITY AND STANDARD OF LEARNING AND TEACHING

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards -

- Module reviews (student questionnaires and teaching team report).
- Annual course review prepared by the course director and reviewed by peers at Faculty and University level.
- External Examiner's reports.
- Consultation with the faculty's industrial liaison panel.
- University procedures for initial approval and periodic re-approval.
- Course accreditation by the British Computer Society.
- Peer teaching observations and feedback.
- Annual staff appraisals.

Committees with responsibility for monitoring and evaluating quality

- Staff Student Consultative Committee
- Course committee
- Board of Examiners
- School Board
- Faculty Academic Affairs Committee
- University Teaching and Learning Committee.

Mechanisms for gaining student feedback on the quality of their learning experience

- Staff-Student Consultative Committee
- Student representatives on School and Faculty boards
- Module evaluation questionnaires / module forum / module freeform responses
- University questionnaires on course completion
- Feed back to the Course Director in his capacity as personal tutor.

Staff development includes:

- Updating in the subject through research, scholarship and academic enterprise
- Consultancy

16 REGULATION OF STANDARDS

Assessment rules

- Pass mark for course, module and individual assessments = 50%.
- Full details of module assessment are set out in each module booklet.
- Students must pass the dissertation to be awarded a Master's degree.
- An average mark of 70% in the taught modules (subject to further distribution requirements given in the Course Regulations) qualifies for PG Dip with Distinction.
- An average mark of 70% in the taught modules AND dissertation (subject to further distribution requirements given in the Course Regulations) qualifies for M Sc with Distinction.

External Examiners

There is 1 external examiner for the course. External examiners are academic subject or professional experts appointed from outside the University. Their key functions are to contribute to the assurance of the standards of the award and the fair treatment of students. They are involved

in the moderation and approval of assessments and the moderation of the marking undertaken by internal examiners.

17 INDICATORS OF QUALITY RELATING TO LEARNING AND TEACHING

- The predecessor course, PG Dip / M Sc in Informatics, was last accredited by the British Computer Society in October 2002 for FIVE intakes starting 2002-03. M Sc in Informatics graduates are exempt from BCS examination requirements for Professional Graduate Diploma and PGD project; holders of PG Dip in Informatics are exempt from BCS examinations for Professional Graduate Diploma.
- The contribution and commitment of school staff was commended by the Quality Assurance Agency for Higher Education (QAA) in its draft report on the institutional audit that it carried out in April 2005.
- Many school members are also members of the Higher Education Academy.
- Three school staff have received the university's Distinguished Teaching Award.
- One member of staff was the recipient of the British Computer Society's IT Professional of the Year award for 2006.
- Research Assessment Exercise rating of 4 (2001).
- External funding for learning and teaching initiatives of the order of £500,000 per annum till 2008-09. This is through the Higher Education Academy's Centre for Information and Computing Sciences which is hosted by the School of Computing and Mathematics.
- The School also hosts the Centre for Software Process Technologies with a brief to vitalise the software industry in Northern Ireland by engaging in 'applied research with commercial software development organisations to improve the efficiency, effectiveness and quality of their processes and products' (<http://www.infc.ulst.ac.uk/informatics/cspt/aboutCSPT.html>). The teaching of software engineering benefits directly from the expertise available in the centre.

**UNIVERSITY OF ULSTER
PROGRAMME SPECIFICATION**

COURSE TITLE: PG Dip/ M Sc in Computing (Web Technology)

PLEASE NOTE: This specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he or she takes full advantage of the learning opportunities provided. More detailed information on the specific learning outcomes, content and the learning, teaching and assessment methods of each module can be found at www.infj.ulster.ac.uk/~cbdq23/admin/pgd_msc_computing.html and in the programme handbook.

1 AWARDING INSTITUTION:	UNIVERSITY OF ULSTER
2 TEACHING INSTITUTION:	UNIVERSITY OF ULSTER
3 LOCATION:	Jordanstown
4 TO BE ACCREDITED BY:	British Computer Society
5 FINAL AWARD:	M Sc in Computing (Web Technology)
6 MODE OF ATTENDANCE:	Part-time or Full-time
7 SPECIALISMS:	Computing
8 COURSE CODE:	To be assigned
9 DATE REVISED:	2007/08

10 EDUCATIONAL AIMS OF THE COURSE

To provide graduates in the field of computer science and related disciplines with advanced knowledge of computing, the competence to apply the most recent techniques in the area and the ability to critically evaluate current research and practice:

- to enable graduates to evaluate current research in software engineering and related disciplines;
- to provide graduates already in industry with the opportunity to enhance their practice and experience with knowledge of the theory of computing;
- to make graduates familiar with best practice and state-of-the-art approaches to software engineering and related disciplines;
- to enable graduates to contribute to the management of the software engineering process in a complex environment and to evaluate its impact;
- to develop in students the ability to communicate effectively a complex argument concerning computer science;
- to have students carry out a substantial piece of work involving scholarship and critical evaluation in an area of

web technology and resulting in a dissertation (M Sc only).

11 MAIN LEARNING OUTCOMES

The following reference points were used to inform the development of the programme and its learning outcomes:

- the University's Vision and core strategic aims, teaching and learning strategy and policies;
- current research or other advanced scholarship carried out by academic staff;
- requirements of professional, statutory or regulatory bodies (the British Computer Society);
- national and University qualifications and credit frameworks;

The course provides opportunities for students to achieve and demonstrate the following learning.

11K SUBJECT RELATED QUALITIES

Knowledge and Understanding

Successful students will be able to:

- K1 design, build, deploy and evaluate distributed computing systems;
- K2 apply the principles and techniques for storage, manipulation and retrieval of data to practical problems;
- K3 develop robust, reliable software in a well managed engineering process;
- K4 employ a range of established and emerging technologies for building computational systems, especially using web technology;
- K5 design and deploy a variety of architectures for computational systems, especially using web technology.

PG Dip: K1-K5

M Sc: K1-K5

Teaching and Learning Methods: Lectures, tutorials, seminars, practical sessions, self-study, project work for dissertation (M Sc only).

Assessment Methods: Coursework assessment, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11I INTELLECTUAL QUALITIES

Successful students will be able to:

- I1 abstract and model a wide range of real-world problems in terms of computer science concepts;
- I2 conceptualise original design solutions to a wide range computer science problems;
- I3 critically evaluate and integrate the arguments of others in the area of computer science research and/or professional practice;
- I4 reason critically in the area of computer science and software engineering, especially web technology.

PG Dip: I1-I4
M Sc: I1-I4

Learning and Teaching Methods: Lectures, student-led seminars, practical work and self-directed learning employing research based materials.

Assessment Methods: Coursework related to case studies and projects, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11P PROFESSIONAL/PRACTICAL SKILLS

Successful students will be able to:

- P1 specify a complex computer-based system using tools and techniques from best practice in software engineering;
- P2 design, implement and evaluate software solutions to problems in their professional area of interest and in the process respond to changes in the problem area, and the software and hardware available;
- P3 write reports, using complex arguments, for various audiences, users, management, other professionals and/or the academic community;
- P4 undertake a substantial piece of work in an area at the forefront of research or practice in web technology and report on it professionally.

PG Dip: P1-P3
M Sc: P1-P4

Learning and Teaching Methods: Lectures, tutorials, problem-based seminars and practical work, coursework, project work (including literature review).

Assessment Methods: Coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

11T TRANSFERABLE SKILLS

Successful students will be able to:

- T1 structure complex ideas and convey them both orally and in writing, to a range of audiences;
- T2 apply project management techniques to a programme of work;
- T3 act ethically as a researcher and computing professional;

T4 manage their own learning, taking responsibility for continuing professional development.

PG Dip: T1-T4

M Sc: T1-T4

Learning and Teaching Methods: Lectures, tutorials, self-directed study, seminars and practical sessions, project.

Assessment Methods: Seminars, coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

.

MODULE OUTCOME MAP: PG Dip in Computing (Web Technology)

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I1	I2	I3	I4	P1	P2	P3	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x	x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x	x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x			x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x				x	x
COM916J2	Research Methods	7								x	x			x	x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x	x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x				x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x	x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x	x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x					x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x	x			x
COM838J1	Health Informatics	7	x	x					x	x	x	x	x	x	x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x	x			x

MODULE OUTCOME MAP: M Sc in Computing (Web Technology)

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I1	I2	I3	I4	P1	P2	P3	P4	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x		x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x		x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x				x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x					x	x
COM916J2	Research Methods	7								x	x			x		x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x		x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x					x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x		x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x		x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x						x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x		x			x
COM838J1	Health Informatics	7	x	x					x	x	x	x	x	x		x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x		x			x
COM878J4	Dissertation	7	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

12 STRUCTURE AND REQUIREMENTS FOR THE AWARD

This course is studied part-time over a period of three years or full-time over a period of one year. The taught component of the programme is worth 120 credit points. It comprises eight modules of study: seven compulsory modules and one optional module (each worth 15 credit points). Having completed the taught modules, students undertake a dissertation worth 60 credit points.

All modules are taught over the period of a semester of 15 weeks duration which includes the examination period. The study units within the course, both compulsory and optional, the levels at which they are studied and the credit ratings are shown below.

Students who complete the taught component of the course satisfactorily are eligible for Postgraduate Diploma in Computing (Web Technology). On completion of the dissertation module, students are awarded the degree of Master of Science in Computing (Web Technology).

The language of instruction is English.

Module Title	Credit Level	Credit Points	Status⁴	Award
Distributed Systems	7	15	C	
Software Processes and Process Improvement	7	15	C	
Reliable Software Development	7	15	C	
Databases for Structured and Semi-Structured Data	7	15	C	
Research Methods	7	15	C	
Mobile and Wireless Networks	7	15	O	
Autonomic Computing and Communications	7	15	O	
Advanced Web Technologies	7	15	C	
E-Business Innovation	7	15	C	
Intelligent Agents	7	15	O	
Applied Computational Intelligence	7	15	O	
Health Informatics	7	15	O	
Emerging Healthcare Technologies	7	15	O	PG Dip
Dissertation	7	60	C	M Sc

(Normally Autonomic Computing and Communications, Applied Computational Intelligence and Emerging Healthcare Technologies are not available in this specialism. However, a student who is exempt from one or

⁴ Compulsory or Optional

more 2nd semester modules because of credits earned elsewhere may choose one of these instead of a 1st semester option).

13 SUPPORT FOR STUDENTS AND THEIR LEARNING

Students and their learning are supported in a number of ways:

- Course handbook and a Module Handout for each module;
- Library pack and specialised introduction to electronic resources in the library;
- Extensive library and other learning resources, including on-line journals;
- Over six computer laboratories with a wide range of software;
- Intranet with a wide range of learning support material;
- CD-ROM with a wide range of software, tutorials and information resources;
- Student e-mail accounts and full access to the Internet;
- Course director acts as a personal tutor.
- Induction process
- Personal Development Planning
- Careers Development Centre
- Student Support Department
- Sport and Recreation Department
- International Office
- Student's Union
- Chaplaincy

14 CRITERIA FOR ADMISSION

Applicants must hold a degree or equivalent in Computer Science or a related discipline or demonstrate their ability to undertake the course through the accreditation of prior experiential learning.

15 EVALUATING AND IMPROVING THE QUALITY AND STANDARD OF LEARNING AND TEACHING

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards -

- Module reviews (student questionnaires and teaching team report).
- Annual course review prepared by the course director and reviewed by peers at Faculty and University level.
- External Examiner's reports.
- Consultation with the faculty's industrial liaison panel.
- University procedures for initial approval and periodic re-approval.
- Course accreditation by the British Computer Society.
- Peer teaching observations and feedback.
- Annual staff appraisals.

Committees with responsibility for monitoring and evaluating quality

- Staff Student Consultative Committee
- Course committee
- Board of Examiners
- School Board
- Faculty Academic Affairs Committee
- University Teaching and Learning Committee.

Mechanisms for gaining student feedback on the quality of their learning experience

- Staff-Student Consultative Committee
- Student representatives on School and Faculty boards
- Module evaluation questionnaires / module forum / module freeform responses
- University questionnaires on course completion
- Feed back to the Course Director in his capacity as personal tutor.

Staff development includes:

- Updating in the subject through research, scholarship and academic enterprise
- Consultancy.

16 REGULATION OF STANDARDS

Assessment rules

- Pass mark for course, module and individual assessments = 50%.
- Full details of module assessment are set out in each module booklet.
- Students must pass the dissertation to be awarded a Master's degree.
- An average mark of 70% in the taught modules (subject to further distribution requirements given in the Course Regulations) qualifies for PG Dip with Distinction.
- An average mark of 70% in the taught modules AND dissertation (subject to further distribution requirements given in the Course Regulations) qualifies for M Sc with Distinction.

External Examiners

There is 1 external examiner for the course. External examiners are academic subject or professional experts appointed from outside the University. Their key functions are to contribute to the assurance of the standards of the award and the fair treatment of students. They are involved in the moderation and approval of assessments and the moderation of the marking undertaken by internal examiners.

17 INDICATORS OF QUALITY RELATING TO LEARNING AND TEACHING

- The predecessor course, PG Dip / M Sc in Informatics, was last accredited by the British Computer Society in October 2002 for FIVE intakes starting 2002-03. M Sc in Informatics graduates are exempt from BCS examination requirements for Professional Graduate Diploma and PGD project; holders of PG Dip in Informatics are exempt from BCS examinations for Professional Graduate Diploma.
- The contribution and commitment of school staff was commended by the Quality Assurance Agency for Higher Education (QAA) in its draft report on the institutional audit that it carried out in April 2005.
- Many school members are also members of the Higher Education Academy.
- Three school staff have received the university's Distinguished Teaching Award.
- One member of staff was the recipient of the British Computer Society's IT Professional of the Year award for 2006.
- Research Assessment Exercise rating of 4 (2001).
- External funding for learning and teaching initiatives of the order of £500,000 per annum till 2008-09. This is through the Higher Education Academy's Centre for Information and Computing Sciences which is hosted by the School of Computing and Mathematics.
- The School also hosts the Centre for Software Process Technologies with a brief to vitalise the software industry in Northern Ireland by engaging in 'applied research with commercial software development organisations to improve the efficiency, effectiveness and quality of their processes and products' (<http://www.infc.ulst.ac.uk/informatics/cspt/aboutCSPT.html>). The teaching of software engineering benefits directly from the expertise available in the centre.

**UNIVERSITY OF ULSTER
PROGRAMME SPECIFICATION**

COURSE TITLE: PG Dip/ M Sc in Computing (Artificial Intelligence)

PLEASE NOTE: This specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he or she takes full advantage of the learning opportunities provided. More detailed information on the specific learning outcomes, content and the learning, teaching and assessment methods of each module can be found at www.infj.ulster.ac.uk/~cbdq23/admin/pgd_msc_computing.html and in the programme handbook.

- 1 **AWARDING INSTITUTION:** UNIVERSITY OF ULSTER
- 2 **TEACHING INSTITUTION:** UNIVERSITY OF ULSTER
- 3 **LOCATION:** Jordanstown
- 4 **TO BE ACCREDITED BY:** British Computer Society
- 5 **FINAL AWARD:** M Sc in Computing (Artificial Intelligence)
- 6 **MODE OF ATTENDANCE:** Part-time or Full-time
- 7 **SPECIALISMS:** Computing
- 8 **COURSE CODE:** To be assigned
- 9 **DATE REVISED:** 2007/08

10 EDUCATIONAL AIMS OF THE COURSE

To provide graduates in the field of computer science and related disciplines with advanced knowledge of computing, the competence to apply the most recent techniques in the area and the ability to critically evaluate current research and practice:

- to enable graduates to evaluate current research in software engineering and related disciplines;
- to provide graduates already in industry with the opportunity to enhance their practice and experience with knowledge of the theory of computing;
- to make graduates familiar with best practice and state-of-the-art approaches to software engineering and related disciplines;
- to enable graduates to contribute to the management of the software engineering process in a complex environment and to evaluate its impact;
- to develop in students the ability to communicate effectively a complex argument concerning computer science;
- to have students carry out a substantial piece of work involving scholarship and critical evaluation in an area of

artificial intelligence and resulting in a dissertation (M Sc only).

11 MAIN LEARNING OUTCOMES

The following reference points were used to inform the development of the programme and its learning outcomes:

- the University's Vision and core strategic aims, teaching and learning strategy and policies;
- current research or other advanced scholarship carried out by academic staff;
- requirements of professional, statutory or regulatory bodies (the British Computer Society);
- national and University qualifications and credit frameworks;

The course provides opportunities for students to achieve and demonstrate the following learning.

11K SUBJECT RELATED QUALITIES

Knowledge and Understanding

Successful students will be able to:

- K1 design, build, deploy and evaluate distributed computing systems;
- K2 apply the principles and techniques for storage, manipulation and retrieval of data to practical problems;
- K3 develop robust, reliable software in a well managed engineering process;
- K4 employ a range of established and emerging technologies for building computational systems, especially using artificial intelligence;
- K5 design and deploy a variety of architectures for computational systems, especially using artificial intelligence.

PG Dip: K1-K5

M Sc: K1-K5

Teaching and Learning Methods: Lectures, tutorials, seminars, practical sessions, self-study, project work for dissertation (M Sc only).

Assessment Methods: Coursework assessment, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11I INTELLECTUAL QUALITIES

Successful students will be able to:

- I1 abstract and model a wide range of real-world problems in terms of computer science concepts;

- I2 conceptualise original design solutions to a wide range computer science problems;
- I3 critically evaluate and integrate the arguments of others in the area of computer science research and/or professional practice;
- I4 reason critically in the area of computer science and software engineering, especially artificial intelligence.

PG Dip: I1-I4

M Sc: I1-I4

Learning and Teaching Methods: Lectures, student-led seminars, practical work and self-directed learning employing research based materials.

Assessment Methods: Coursework related to case studies and projects, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11P PROFESSIONAL/PRACTICAL SKILLS

Successful students will be able to:

- P1 specify a complex computer-based system using tools and techniques from best practice in software engineering;
- P2 design, implement and evaluate software solutions to problems in their professional area of interest and in the process respond to changes in the problem area, and the software and hardware available;
- P3 write reports, using complex arguments, for various audiences, users, management, other professionals and/or the academic community;
- P4 undertake a substantial piece of work in an area at the forefront of research or practice in artificial intelligence and report on it professionally.

PG Dip: P1-P3

M Sc: P1-P4

Learning and Teaching Methods: Lectures, tutorials, problem-based seminars and practical work, coursework, project work (including literature review).

Assessment Methods: Coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

11T TRANSFERABLE SKILLS

Successful students will be able to:

- T1 structure complex ideas and convey them both orally and in writing, to a range of audiences;
- T2 apply project management techniques to a programme of work;
- T3 act ethically as a researcher and computing professional;
- T4 manage their own learning, taking responsibility for continuing professional development.

PG Dip: T1-T4

M Sc: T1-T4

Learning and Teaching Methods: Lectures, tutorials, self-directed study, seminars and practical sessions, project.

Assessment Methods: Seminars, coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

MODULE OUTCOME MAP: PG Dip in Computing (Artificial Intelligence)

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I1	I2	I3	I4	P1	P2	P3	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x	x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x	x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x			x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x				x	x
COM916J2	Research Methods	7								x	x			x	x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x	x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x				x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x	x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x	x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x					x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x	x			x
COM838J1	Health Informatics	7	x	x					x	x	x	x	x	x	x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x	x			x

MODULE OUTCOME MAP: M Sc in Computing (Artificial Intelligence)

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I1	I2	I3	I4	P1	P2	P3	P4	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x		x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x		x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x				x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x					x	x
COM916J2	Research Methods	7								x	x			x		x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x		x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x					x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x		x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x		x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x						x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x		x			x
COM838J1	Health Informatics	7	x	x					x	x	x	x	x	x		x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x		x			x
COM878J4	Dissertation	7	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

12 STRUCTURE AND REQUIREMENTS FOR THE AWARD

This course is studied part-time over a period of three years or full-time over a period of one year. The taught component of the programme is worth 120 credit points. It comprises eight modules of study: seven compulsory modules and one optional module (each worth 15 credit points). Having completed the taught modules, students undertake a dissertation worth 60 credit points.

All modules are taught over the period of a semester of 15 weeks duration which includes the examination period. The study units within the course, both compulsory and optional, the levels at which they are studied and the credit ratings are shown below.

Students who complete the taught component of the course satisfactorily are eligible for Postgraduate Diploma in Computing (Artificial Intelligence). On completion of the dissertation module, students are awarded the degree of Master of Science in Computing (Artificial Intelligence).

The language of instruction is English.

Module Title	Credit Level	Credit Points	Status ⁵	Award
Distributed Systems	7	15	C	
Software Processes and Process Improvement	7	15	C	
Reliable Software Development	7	15	C	
Databases for Structured and Semi-Structured Data	7	15	C	
Research Methods	7	15	C	
Mobile and Wireless Networks	7	15	O	
Autonomic Computing and Communications	7	15	O	
Advanced Web Technologies	7	15	O	
E-Business Innovation	7	15	O	
Intelligent Agents	7	15	C	
Applied Computational Intelligence	7	15	C	
Health Informatics	7	15	O	
Emerging Healthcare Technologies	7	15	O	PG Dip
Dissertation	7	60	C	M Sc

(Normally Autonomic Computing and Communications, E-Business Innovation and Emerging Healthcare Technologies are not available in this specialism. However, a student who is exempt from one or more 2nd semester modules

⁵ Compulsory or Optional

because of credits earned elsewhere may choose one of these instead of a 1st semester option).

13 SUPPORT FOR STUDENTS AND THEIR LEARNING

Students and their learning are supported in a number of ways:

- Course handbook and a Module Handout for each module;
- Library pack and specialised introduction to electronic resources in the library;
- Extensive library and other learning resources, including on-line journals;
- Over six computer laboratories with a wide range of software;
- Intranet with a wide range of learning support material;
- CD-ROM with a wide range of software, tutorials and information resources;
- Student e-mail accounts and full access to the Internet;
- Course director acts as a personal tutor.
- Induction process
- Personal Development Planning
- Careers Development Centre
- Student Support Department
- Sport and Recreation Department
- International Office
- Student's Union
- Chaplaincy

14 CRITERIA FOR ADMISSION

Applicants must hold a degree or equivalent in Computer Science or a related discipline or demonstrate their ability to undertake the course through the accreditation of prior experiential learning.

15 EVALUATING AND IMPROVING THE QUALITY AND STANDARD OF LEARNING AND TEACHING

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards -

- Module reviews (student questionnaires and teaching team report).
- Annual course review prepared by the course director and reviewed by peers at Faculty and University level.
- External Examiner's reports.
- Consultation with the faculty's industrial liaison panel.
- University procedures for initial approval and periodic re-approval.
- Course accreditation by the British Computer Society.
- Peer teaching observations and feedback.
- Annual staff appraisals.

Committees with responsibility for monitoring and evaluating quality

- Staff Student Consultative Committee
- Course committee
- Board of Examiners
- School Board
- Faculty Academic Affairs Committee
- University Teaching and Learning Committee.

Mechanisms for gaining student feedback on the quality of their learning experience

- Staff-Student Consultative Committee
- Student representatives on School and Faculty boards
- Module evaluation questionnaires / module forum / module freeform responses
- University questionnaires on course completion
- Feed back to the Course Director in his capacity as personal tutor.

Staff development includes:

- Updating in the subject through research, scholarship and academic enterprise
- Consultancy.

16 REGULATION OF STANDARDS

Assessment rules

- Pass mark for course, module and individual assessments = 50%.
- Full details of module assessment are set out in each module booklet.
- Students must pass the dissertation to be awarded a Master's degree.
- An average mark of 70% in the taught modules (subject to further distribution requirements given in the Course Regulations) qualifies for PG Dip with Distinction.
- An average mark of 70% in the taught modules AND dissertation (subject to further distribution requirements given in the Course Regulations) qualifies for M Sc with Distinction.

External Examiners

There is 1 external examiner for the course. External examiners are academic subject or professional experts appointed from outside the University. Their key functions are to contribute to the assurance of the standards of the award and the fair treatment of students. They are involved in the moderation and approval of assessments and the moderation of the marking undertaken by internal examiners.

17 INDICATORS OF QUALITY RELATING TO LEARNING AND TEACHING

- The predecessor course, PG Dip / M Sc in Informatics, was last accredited by the British Computer Society in October 2002 for FIVE intakes starting 2002-03. M Sc in Informatics graduates are exempt from BCS examination requirements for Professional Graduate Diploma and PGD project; holders of PG Dip in Informatics are exempt from BCS examinations for Professional Graduate Diploma.
- The contribution and commitment of school staff was commended by the Quality Assurance Agency for Higher Education (QAA) in its draft report on the institutional audit that it carried out in April 2005.
- Many school members are also members of the Higher Education Academy.
- Three school staff have received the university's Distinguished Teaching Award.
- One member of staff was the recipient of the British Computer Society's IT Professional of the Year award for 2006.
- Research Assessment Exercise rating of 4 (2001).
- External funding for learning and teaching initiatives of the order of £500,000 per annum till 2008-09. This is through the Higher Education Academy's Centre for Information and Computing Sciences which is hosted by the School of Computing and Mathematics.
- The School also hosts the Centre for Software Process Technologies with a brief to vitalise the software industry in Northern Ireland by engaging in 'applied research with commercial software development organisations to improve the efficiency, effectiveness and quality of their processes and products' (<http://www.infc.ulst.ac.uk/informatics/cspt/aboutCSPT.html>). The teaching of software engineering benefits directly from the expertise available in the centre.

**UNIVERSITY OF ULSTER
PROGRAMME SPECIFICATION**

COURSE TITLE: PG Dip/ M Sc in Computing (Health Informatics)

PLEASE NOTE: This specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he or she takes full advantage of the learning opportunities provided. More detailed information on the specific learning outcomes, content and the learning, teaching and assessment methods of each module can be found at www.infi.ulster.ac.uk/~cbdq23/admin/pgd_msc_computing.html and in the programme handbook.

1	AWARDING INSTITUTION:	UNIVERSITY OF ULSTER
2	TEACHING INSTITUTION:	UNIVERSITY OF ULSTER
3	LOCATION:	Jordanstown
4	TO BE ACCREDITED BY:	British Computer Society
5	FINAL AWARD:	M Sc in Computing (Healthcare Technology)
6	MODE OF ATTENDANCE:	Part-time or Full-time
7	SPECIALISMS:	Computing
8	COURSE CODE:	To be assigned
9	DATE REVISED:	2007/08

10 **EDUCATIONAL AIMS OF THE COURSE**

To provide graduates in the field of computer science and related disciplines with advanced knowledge of computing, the competence to apply the most recent techniques in the area and the ability to critically evaluate current research and practice:

- to enable graduates to evaluate current research in software engineering and related disciplines;
- to provide graduates already in industry with the opportunity to enhance their practice and experience with knowledge of the theory of computing;
- to make graduates familiar with best practice and state-of-the-art approaches to software engineering and related disciplines;
- to enable graduates to contribute to the management of the software engineering process in a complex environment and to evaluate its impact;
- to develop in students the ability to communicate effectively a complex argument concerning computer science;
- to have students carry out a substantial piece of work involving scholarship and critical evaluation in an area of

health informatics and resulting in a dissertation (M Sc only).

11 MAIN LEARNING OUTCOMES

The following reference points were used to inform the development of the programme and its learning outcomes:

- the University's Vision and core strategic aims, teaching and learning strategy and policies;
- current research or other advanced scholarship carried out by academic staff;
- requirements of professional, statutory or regulatory bodies (the British Computer Society);
- national and University qualifications and credit frameworks;

The course provides opportunities for students to achieve and demonstrate the following learning.

11K SUBJECT RELATED QUALITIES

Knowledge and Understanding

Successful students will be able to:

- K1 design, build, deploy and evaluate distributed computing systems;
- K2 apply the principles and techniques for storage, manipulation and retrieval of data to practical problems;
- K3 develop robust, reliable software in a well managed engineering process;
- K4 employ a range of established and emerging technologies for building computational systems, especially for health informatics;
- K5 design and deploy a variety of architectures for computational systems, especially for health informatics.

PG Dip: K1-K5

M Sc: K1-K5

Teaching and Learning Methods: Lectures, tutorials, seminars, practical sessions, self-study, project work for dissertation (M Sc only).

Assessment Methods: Coursework assessment, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11I INTELLECTUAL QUALITIES

Successful students will be able to:

- I1 abstract and model a wide range of real-world problems in terms of computer science concepts;

- I2 conceptualise original design solutions to a wide range computer science problems;
- I3 critically evaluate and integrate the arguments of others in the area of computer science research and/or professional practice;
- I4 reason critically in the area of computer science and software engineering, especially health informatics.

PG Dip: I1-I4

M Sc: I1-I4

Learning and Teaching Methods: Lectures, student-led seminars, practical work and self-directed learning employing research based materials.

Assessment Methods: Coursework related to case studies and projects, written examinations, dissertation examination including project oral (M Sc only), project poster (M Sc only).

11P PROFESSIONAL/PRACTICAL SKILLS

Successful students will be able to:

- P1 specify a complex computer-based system using tools and techniques from best practice in software engineering;
- P2 design, implement and evaluate software solutions to problems in their professional area of interest and in the process respond to changes in the problem area, and the software and hardware available;
- P3 write reports, using complex arguments, for various audiences, users, management, other professionals and/or the academic community;
- P4 undertake a substantial piece of work in an area at the forefront of research or practice in health informatics and report on it professionally.

PG Dip: P1-P3

M Sc: P1-P4

Learning and Teaching Methods: Lectures, tutorials, problem-based seminars and practical work, coursework, project work (including literature review).

Assessment Methods: Coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

11T TRANSFERABLE SKILLS

Successful students will be able to:

- T1 structure complex ideas and convey them both orally and in writing, to a range of audiences;
- T2 apply project management techniques to a programme of work;
- T3 act ethically as a researcher and computing professional;
- T4 manage their own learning, taking responsibility for continuing professional development.

PG Dip: T1-T4

M Sc: T1-T4

Learning and Teaching Methods: Lectures, tutorials, self-directed study, seminars and practical sessions, project.

Assessment Methods: Seminars, coursework assessment, written examinations, dissertation assessment including project oral (M Sc only), project poster (M Sc only).

.

MODULE OUTCOME MAP: PG Dip in Computing (Health Informatics)

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I1	I2	I3	I4	P1	P2	P3	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x	x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x	x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x			x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x				x	x
COM916J2	Research Methods	7								x	x			x	x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x	x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x				x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x	x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x	x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x					x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x	x			x
COM838J1	Health Informatics	7	x	x		x			x	x	x	x	x	x	x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x	x			x

MODULE OUTCOME MAP: M Sc in Computing (Health Informatics)

Please Note: The matrix displays only the measurable programme outcomes and where these are developed and assessed within the modules offered in the programme.

Module Code	Module Title	Level	K1	K2	K3	K4	K5	I1	I2	I3	I4	P1	P2	P3	P4	T1	T2	T3	T4
COM872J1	Distributed Systems	7	x	x	x	x	x	x	x	x	x		x	x		x		x	x
COM913J1	Software Processes and Process Improvement	7			x			x		x	x			x		x	x	x	x
COM914J2	Reliable Software Development	7	x		x	x	x	x	x	x	x	x	x				x	x	x
COM915J2	Databases for Structured and Semi-Structured Data	7		x		x	x	x	x	x	x	x	x					x	x
COM916J2	Research Methods	7								x	x			x		x	x	x	x
COM877J1	Mobile and Wireless Networks	7	x			x	x	x	x	x	x	x	x	x		x			x
COM834J2	Autonomic Computing and Communications	7	x			x	x	x	x	x	x			x					x
COM835J1	Advanced Web Technologies	7	x	x		x	x	x	x			x	x	x		x			x
COM917J2	E-Business Innovation	7	x			x				x	x			x		x		x	x
COM836J1	Intelligent Agents	7	x			x	x	x	x		x	x	x						x
COM837J2	Applied Computational Intelligence	7				x	x	x	x	x	x	x	x	x		x			x
COM838J1	Health Informatics	7	x	x		x			x	x	x	x	x	x		x		x	x
COM725J2	Emerging Healthcare Technologies	7				x	x		x	x	x	x	x	x		x			x
COM878J4	Dissertation	7	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

12 STRUCTURE AND REQUIREMENTS FOR THE AWARD

This course is studied part-time over a period of three years or full-time over a period of one year. The taught component of the programme is worth 120 credit points. It comprises eight modules of study: seven compulsory modules and one optional module (each worth 15 credit points). Having completed the taught modules, students undertake a dissertation worth 60 credit points.

All modules are taught over the period of a semester of 15 weeks duration which includes the examination period. The study units within the course, both compulsory and optional, the levels at which they are studied and the credit ratings are shown below.

Students who complete the taught component of the course satisfactorily are eligible for Postgraduate Diploma in Computing (Health Informatics). On completion of the dissertation module, students are awarded the degree of Master of Science in Computing (Health Informatics).

The language of instruction is English.

Module Title	Credit Level	Credit Points	Status⁶	Award
Distributed Systems	7	15	C	
Software Processes and Process Improvement	7	15	C	
Reliable Software Development	7	15	C	
Databases for Structured and Semi-Structured Data	7	15	C	
Research Methods	7	15	C	
Mobile and Wireless Networks	7	15	O	
Autonomic Computing and Communications	7	15	O	
Advanced Web Technologies	7	15	O	
E-Business Innovation	7	15	O	
Intelligent Agents	7	15	O	
Applied Computational Intelligence	7	15	O	
Health Informatics	7	15	C	
Emerging Healthcare Technologies	7	15	C	PG Dip
Dissertation	7	60	C	M Sc

(Normally Autonomic Computing and Communications, E-Business Innovation and Applied Computational Intelligence are not available in this specialism. However, a student who is exempt from one or more 2nd semester modules

⁶ Compulsory or Optional

because of credits earned elsewhere may choose one of these instead of a 1st semester option).

13 SUPPORT FOR STUDENTS AND THEIR LEARNING

Students and their learning are supported in a number of ways:

- Course handbook and a Module Handout for each module;
- Library pack and specialised introduction to electronic resources in the library;
- Extensive library and other learning resources, including on-line journals;
- Over six computer laboratories with a wide range of software;
- Intranet with a wide range of learning support material;
- CD-ROM with a wide range of software, tutorials and information resources;
- Student e-mail accounts and full access to the Internet;
- Course director acts as a personal tutor.
- Induction process
- Personal Development Planning
- Careers Development Centre
- Student Support Department
- Sport and Recreation Department
- International Office
- Student's Union
- Chaplaincy

14 CRITERIA FOR ADMISSION

Applicants must hold a degree or equivalent in Computer Science or a related discipline or demonstrate their ability to undertake the course through the accreditation of prior experiential learning.

15 EVALUATING AND IMPROVING THE QUALITY AND STANDARD OF LEARNING AND TEACHING

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards -

- Module reviews (student questionnaires and teaching team report).
- Annual course review prepared by the course director and reviewed by peers at Faculty and University level.
- External Examiner's reports.
- Consultation with the faculty's industrial liaison panel.
- University procedures for initial approval and periodic re-approval.
- Course accreditation by the British Computer Society.
- Peer teaching observations and feedback.
- Annual staff appraisals.

Committees with responsibility for monitoring and evaluating quality

- Staff Student Consultative Committee
- Course committee
- Board of Examiners
- School Board
- Faculty Academic Affairs Committee
- University Teaching and Learning Committee.

Mechanisms for gaining student feedback on the quality of their learning experience

- Staff-Student Consultative Committee
- Student representatives on School and Faculty boards
- Module evaluation questionnaires / module forum / module freeform responses
- University questionnaires on course completion
- Feed back to the Course Director in his capacity as personal tutor.

Staff development includes:

- Updating in the subject through research, scholarship and academic enterprise
- Consultancy.

16 REGULATION OF STANDARDS

Assessment rules

- Pass mark for course, module and individual assessments = 50%.
- Full details of module assessment are set out in each module booklet.
- Students must pass the dissertation to be awarded a Master's degree.
- An average mark of 70% in the taught modules (subject to further distribution requirements given in the Course Regulations) qualifies for PG Dip with Distinction.
- An average mark of 70% in the taught modules AND dissertation (subject to further distribution requirements given in the Course Regulations) qualifies for M Sc with Distinction.

External Examiners

There is 1 external examiner for the course. External examiners are academic subject or professional experts appointed from outside the University. Their key functions are to contribute to the assurance of the standards of the award and the fair treatment of students. They are involved in the moderation and approval of assessments and the moderation of the marking undertaken by internal examiners.

17 INDICATORS OF QUALITY RELATING TO LEARNING AND TEACHING

- The predecessor course, PG Dip / M Sc in Informatics, was last accredited by the British Computer Society in October 2002 for FIVE intakes starting 2002-03. M Sc in Informatics graduates are exempt from BCS examination requirements for Professional Graduate Diploma and PGD project; holders of PG Dip in Informatics are exempt from BCS examinations for Professional Graduate Diploma.
- The contribution and commitment of school staff was commended by the Quality Assurance Agency for Higher Education (QAA) in its draft report on the institutional audit that it carried out in April 2005.
- Many school members are also members of the Higher Education Academy.
- Three school staff have received the university's Distinguished Teaching Award.
- One member of staff was the recipient of the British Computer Society's IT Professional of the Year award for 2006.
- Research Assessment Exercise rating of 4 (2001).

- External funding for learning and teaching initiatives of the order of £500,000 per annum till 2008-09. This is through the Higher Education Academy's Centre for Information and Computing Sciences which is hosted by the School of Computing and Mathematics.
- The School also hosts the Centre for Software Process Technologies with a brief to vitalise the software industry in Northern Ireland by engaging in 'applied research with commercial software development organisations to improve the efficiency, effectiveness and quality of their processes and products' (<http://www.infc.ulst.ac.uk/informatics/cspt/aboutCSPT.html>). The teaching of software engineering benefits directly from the expertise available in the centre.

B2: Commentary

B2.1: Academic Progression, Coherence and Student Choice

PG Cert/ PG Dip / M Sc in Computing offers graduates of computing and related disciplines and industry professionals with equivalent skills the opportunity to develop advanced skills in the broad area of computing and software engineering. Postgraduate Certificate/ Postgraduate Diploma acquires its distinctive character through five compulsory modules. The following four,

COM872J1 Distributed Systems,
COM913J1 Software Processes and Process Improvement,
COM914J2 Reliable Software Development and
COM915J2 Databases for Structured and Semi-Structured Data

are designed to develop technical skills in the core areas of distributed computing, databases and software engineering as well as softer but equally vital skill in the area of process improvement. Students who complete these four modules qualify for the award of Postgraduate Certificate in Computing.

For Postgraduate Diploma in Computing , the compulsory modules are rounded off by COM916J2 Research Methods which emphasises equally the unique engineering, scientific and societal dimensions of computing and is designed to inculcate broad research skills which students will utilise in the M Sc dissertation and later professional life.

The optional modules reflect specialist interests of the teaching staff and will give students an opportunity to sample a range of specialist subject areas that appeal to them. Eight optional modules -- in four specialist areas, namely Computer Communications, Web Technology, Applied Artificial Intelligence and Health Informatics -- are offered of which students are required to take three.

In addition to the five compulsory modules listed earlier, students who wish to obtain **PG Dip/ M Sc in Computing (*with specialism*)** complete two further compulsory modules in the specialism and one optional module outside the specialism (i.e. from another specialism). The specialisms and the corresponding compulsory modules are as follows:

Specialism	Compulsory Module
Communications	Mobile and Wireless Networks
	Autonomic Computing and Communications
Web Technology	Advanced Web Technologies
	E-Business Innovation
Artificial Intelligence	Intelligent Agents
	Applied Computational Intelligence
Health Informatics	Health Informatics
	Emerging Healthcare Technologies

Table B2.1 Computing specialisms and corresponding compulsory modules

On completing the taught component of the course, students commence the M Sc dissertation. Generalist **M Sc in Computing** students may choose a topic in any area of computing whereas **M Sc in Computing (*with specialism*)** students must choose a topic in their specialist area. This gives students the opportunity to integrate and extend what they have learned in the taught modules by undertaking a substantial research and software development exercise. Dissertation topics arise either from research and scholarly activities of teaching staff or from the work experience of students. A representative list of dissertations from the past six years of the predecessor course, M Sc in Informatics, is given in Appendix A1 of Section A; publications and other significant public output is listed in Appendix A2 of Section A.

B2.2 Widening Participation

Like its predecessor course, PG Cert/ PG Dip / M Sc in Computing and PG Dip / M Sc in Computing (*with specialism*) are intended primarily for Computing Science Honours graduates but in accordance with the University's strategy to 'widen access to high quality relevant programmes' and 'to enhance the region's knowledge and skills base' and its now well-established approach to accreditation of prior experiential learning, the Course Committee also welcomes applications from candidates who offer various combinations of academic and experiential qualifications.

Table B2.2 shows the rich range of academic and experiential qualifications offered by students who were admitted to the predecessor course, PG Dip / M Sc in Informatics, between 2001-07.

Admission Criterion	Number
2:2 or better in B Sc (Hons) Computing or a related subject	36
PG Dip or approved professional qualification	3
An equivalent standard in a preliminary exam	0
3rd or non-Honours degree in Computing or a related subject + 2 years experience	6
BCS Part 1 or equivalent + 3 years experience	5
Degree in another discipline + 5 years experience	7
Total	57

Table B2.2: Academic and experiential qualifications of students admitted to PG Dip / M Sc in Informatics between 2001-07. The Admission Criterion refers to corresponding items in *Section 6: Admission Requirements* of the Course Regulations. The analysis is based on approximately 90% of students who were admitted during this period and for whom data is still available.

It is expected that PG Cert/ PG Dip/ M Sc in Computing and PG Dip/ M Sc in Computing (*with specialism*) will attract students with a similar range of backgrounds.

The programmes are offered in full-time and part-time modes and are fully accessible to students with physical disability.

B2.3 Transfer to and from the Programme and Opportunities for Progression to Further Study

The normal route into the courses is through a degree in computing or equivalent qualifications (see previous subsection). On completion of the four core modules students qualify for the award of PG Cert in Computing; on completion of eight taught modules and depending on the non-core modules they have taken, students qualify for the award of either Postgraduate Diploma in Computing or Postgraduate Diploma in Computing (*with specialism*) and are eligible to proceed to corresponding M Sc.

Students can transfer freely between PG Dip/M Sc in Computing and PG Dip/ M Sc with specialism or indeed from one specialism to another. Students who complete M Sc successfully are encouraged to apply for doctoral study.

B2.4 Relationship with Professional Bodies

The predecessor course, PG Dip / M Sc in Informatics was last accredited by the British Computer Society in October 2002 for FIVE intakes starting 2002-03. M Sc in Informatics graduates are exempt from BCS examination requirements for Professional Graduate Diploma and PGD project; holders of PG Dip in Informatics are exempt from BCS examinations for Professional Graduate Diploma.

At the next BCS accreditation visit in Summer 2008, the Course Committee plans to apply for similar accreditation of the new courses.

B 2.5 Teaching, Learning and Assessment

Following the formulation and adoption of the university's Teaching and Learning Strategy in May 2004, the then Faculty of Engineering reviewed the Faculty Teaching and Learning Strategy and identified a number of overarching goals and specific objectives. In the following the Course Committee comments on the extent to which each overarching goal was met in the predecessor course, PG Dip/ M Sc in Informatics, and is met in the proposed courses: PG Cert/ PG Dip/ M Sc in Computing (*with or without specialism*).

- (i) *To admit those students that have the greatest likelihood of achieving the award whilst meeting target admission numbers agreed with the PVC (Teaching & Learning) and maintaining the proportion of students from non-traditional backgrounds (widening access).*

In the past five years, virtually every student who started PG Dip/ M Sc in Informatics completed the Postgraduate Diploma and every full-time student who started the M Sc dissertation completed it. Part-time students are usually juggling a full-time job and family commitments with part-time study. Consequently, the M Sc completion rate for part-time students is around 75%. Nevertheless, all students who start the course are capable of completing it and if they fail to do so, it is only because their personal circumstances conspire against them.

- (ii) *To provide programmes of study (locally and overseas), within bounded resources, that are attractive to applicants, flexible in their delivery, progressive at all levels of award, industrially relevant and provide a sound educational basis for employment and lifelong learning.*

One of the challenges in designing PG Dip/ M Sc in Computing (*with or without specialism*) was to strike a balance between the development of technical skills which would be immediately relevant in the workplace and sound understanding of the underlying principles that would support lifelong learning. The Course Committee firmly believes that, while there will always be room for improvement in such a complex task, in the main, it has succeeded in striking this balance.

Most modules are delivered in a mode comprising two hours of lectures and one hour of practical work each week in a twelve-week term. Autonomic Computing and Communication is taught in 'intensive mode' in two blocks, one of three whole days and another of two days. Emerging Healthcare Technologies is delivered substantially online through WebCT, supported by face-to-face seminars and practicals.

- (iii) *To make judicious use of the resources available to the Faculty to facilitate student learning and provide the best possible student experience.*

The Course Committee arranges for graduating M Sc students to speak to the External Examiner privately in a short 15 minute meeting before the Exam Board. This is an opportunity for the External Examiner to find out directly from students their experience of the course. The following

comment, taken from the External Examiner's report for 2004-05, is fairly typical of the comments made by him at various Exam Boards:

Meetings with students showed them to be remarkably happy with the support they get from lecturers and with the content and usefulness of the course.

- (iv) *To assess students in a manner appropriate to them demonstrating achievement of the learning outcomes at both module and programme level, whilst limiting and balancing their overall assessment load.*

In keeping with the emphasis on practical skills, the coursework component of all modules (except Research Methods and E-Business Innovation) contains substantial practical work with state-of-the-art software. Where a module is not assessed by coursework alone, the coursework/exam weighting of 50/50 reflects the substantial effort that students are required to put into the coursework component. The duration of the examination is 2 hours for all modules. Students are given timely feedback on the coursework. The coursework and examination scripts are moderated by the External Examiner during his visits.

- (v) *To maintain and enhance standards and quality in the Faculty's teaching and learning provision*

Along with other undergraduate and postgraduate courses in the Faculty, PG Dip/ M Sc in Computing (*with or without specialism*) courses are subject to the Faculty's quality assurance mechanisms such as Annual Subject Monitoring and periodic validation. (Further details in Section C4.)

- (vi) *To ensure that students are at least afforded their rights and understand their responsibilities as students.*

These being postgraduate courses, all students will be mature and most will have previously studied at the University of Ulster. Student induction is centred around the Faculty Programme Handbook which contains faculty information, campus information, programme information and the following categories of general information for students:

- Teaching, Learning and Assessment;
- Study Guide;
- Personal Development Planning;
- Behaviour Guide;
- Notes for Students;
- University Contacts;
- Student Support.

B2.6: Standards

The UK Quality Assurance Agency has deemed acceptable and meeting the requirements of the Qualifications Framework the benchmarking standards defined in a report entitled "Towards Benchmarking Standards for Taught Masters Degrees in Computing" by the Council of Professors and Heads of Computing (CPHC). The programmes detailed herein conform to the standards defined in the CPHC report.

B2.7: Employability

B2.7.1: Local Software Industry and Course Design

In revising the course, the Course Committee has been mindful of two major surveys of the Northern Ireland Software Industry:

- *Northern Ireland Software Industry: The State of the Software Art*, a survey conducted by the Centre for Software Process Technologies in the second half of 2002;
- *Momentum Annual Survey 2003-04*.

The Momentum Annual Survey was a survey of broad business trends in the IT sector in Northern Ireland and did not uncover anything that could significantly inform course design. In contrast, the CSPT survey concentrated on the technical 'state of practice' in the local software industry and was very helpful in assessing the industrial relevance of the course.

Some of the needs that were identified in these surveys and the way they are served by the PG Dip / M Sc in Computing (*with or without specialism*) are listed below.

(i) Of the 52 companies covered by the CSPT survey, 39 are engaged in developing web applications, 13 in distributed computing and 33 in transaction processing systems (some companies are engaged in developing more than one kind of system).

Through core modules in distributed computing, software engineering and databases and specialist modules in web technology, the courses overall directly addresses the needs of these companies

(ii) According to the CSPT survey, four specific areas of greatest concern are
estimating task size,
managing risks,
productivity, and
consistency in work practices.

COM913J1 Software Processes and Process Improvement addresses software process improvement (which contributes to consistency in work practices). COM914J2 Reliable Software Development covers state-of-the-art tools and techniques which reduce the risk of failure and contribute to increased productivity.

(iii) "Smaller organizations were more concerned with keeping abreast of new technology, whilst this was not an issue of concern for the larger software companies." (CSPT Survey)

All modules, particularly those which closely reflect the research interests of teaching staff are at the cutting edge of computing practice and would help local industry keep abreast of emerging technologies.

(iv) "General awareness of standards applied to software development are low although there is significant awareness of the ISO9001 family of standards. Too few organizations are aware of the concept of software process improvement for increasing market penetration worldwide, particularly in the USA." (CSPT Survey)

"96% of organizations surveyed regard process as being fundamentally important and after awareness raising sessions by CSPT and the positive experiences of the multinationals, 71% of software companies in NI would desire to engage in some form of software process improvement program, particularly using lighter approaches such as Class C CMMI appraisal methods." (CSPT Survey)

"Increased customer satisfaction and the securing of competitive advantage are the main drivers of quality. 33% of ICT respondents reported having staff dedicated to software quality issues with a further 33% planning to address this in 2004." (Momentum Survey)

30 respondents in the Momentum survey indicated that competitive advantage was one of the key drivers for the introduction of a software quality system. Only 3 and 5 respondents respectively use CMM or CMMI models.

The CSPT has a wider remit to help Northern Ireland Software Industry improve its practices. COM913J1 Software Processes and Process Improvement -- taught by key staff from the CSPT who are also accredited assessors of Capability maturity Model Integration -- is one way in which students are made aware of standards, particularly for software process improvement.

B2.7.2: Graduate Qualities

In accordance with the recommendations of the CPHC report (see section B 2.6), PG Cert/ PG Dip/ M Sc in Computing and PG Dip/ M Sc in Computing (*with specialism*) programmes are characterised by an ethos of advanced work and scholarship which sets them apart from undergraduate computing courses. These postgraduate courses further develop undergraduate qualities by focusing on current professional practice in particular aspects of computing. Practical work is an integral part of teaching and assessment and prepares graduates for employment at the forefront of industry.

B2.7.3: Personal development Planning

The University has recently completed a Personal Development Planning pilot for postgraduate programmes and decided to roll it out to all postgraduate

programmes in 2007-8. PG Dip / M Sc in Computing (*with or without specialism*) is fully committed to embracing this development.

B2.7.4: Entrepreneurship Training

Although there is no explicit module dealing with entrepreneurship, an ethos of entrepreneurship pervades the programme. Most notably, COM917J2 E-Business Innovation concentrates on the deployment of computing technology in the service of electronic business. Students are also introduced to intellectual property rights, patents and dissemination and commercialisation of research (COM916J2 Research Methods).

B2.7.5: Career Opportunities, Development and Progression

University's Career Development Centre collects data on employment of graduating students every year approximately six months after graduation. The most recent data available is for PGD/ M Sc in Informatics students who graduated in Winter 2004 and Summer 2005.

Of the five full-time students who completed M Sc in Informatics, three are now employed in local software industry as Software Engineer, Programmer and Designer respectively, one is a freelance software developer and the fifth student (overseas) did not respond to the survey.

Part-time students are usually employed in local industry and continue in employment during and after the course. Of the seven part-time students who were awarded M Sc in Informatics in this period, four are working in various professional capacities in local software industry, one is a Research Assistant and another an Information Assistant in the University; the seventh student did not respond to the survey.

UNIVERSITY OF ULSTER

COURSE REGULATIONS

1 TITLE

Postgraduate Certificate/ Postgraduate Diploma/ Master of Science in Computing
Postgraduate Diploma/ Master of Science in Computing (Communications)
Postgraduate Diploma/ Master of Science in Computing (Web Technology)
Postgraduate Diploma/ Master of Science in Computing (Artificial Intelligence)
Postgraduate Diploma/ Master of Science in Computing (Health Informatics)

CODES

Postgraduate Certificate in Computing Full-time		6234
Postgraduate Certificate in Computing Part-time		6235
Postgraduate Diploma in Computing with Options Full-time	6220	
Postgraduate Diploma in Computing with Options Part-time	6221	
Master of Science in Computing with Options Full-time		6219
Master of Science in Computing with Options Part-time		6222

2 MODE OF ATTENDANCE

Full-time OR Part-time

3 DURATION

FULL-TIME: Normally 2/3 semesters of study

PART-TIME: Normally 4/6 semesters of study

4 LOCATION

Jordanstown

5 FACULTY

Faculty of Computing and Engineering

6 ADMISSION REQUIREMENTS

Applicants must:

(a) have gained

(i) an Honours or non-Honours degree from a University of the United Kingdom or the Republic of Ireland, from the Council for National Academic Awards, the National Council for Educational Awards, the Higher Education and Training Awards Council, or from an institution of another country which is recognised as being of an equivalent standard; or

(ii) an equivalent standard in a Postgraduate Certificate, Graduate Diploma, Graduate Certificate or an approved alternative qualification;

and

- (b) provide evidence of competence in written and spoken English (GCSE grade C or equivalent);

or as an alternative to (a) (i) or (a) (ii) and/or (b):

- (c) In exceptional circumstances, where an individual has substantial and significant experiential learning, a portfolio of written evidence demonstrating the meeting of graduate qualities (including subject-specific outcomes, as determined by the Course Committee) may be considered as an alternative entrance route. Evidence used to demonstrate graduate qualities may not be used for exemption against modules within the programme.

7 EXEMPTIONS

7.1 Studies pursued and examinations passed in respect of other qualifications awarded by the University or by another university or other educational institution, or evidence from the accreditation of prior experiential learning, may be accepted as exempting candidates from part of the programme provided that

- (a) they shall register as students of the University for modules amounting to at least the final third of the credit value of the award at the highest level in respect of a Master's award and at least 50% of the credit value of the award in respect of a Postgraduate Diploma or Certificate award;
- (b) no exemption shall be permitted from the dissertation.

8 ATTENDANCE REQUIREMENTS

8.1 Students are expected to attend all classes associated with the programme and be punctual and regular in attendance.

8.2 A student who has not been in attendance for more than three days through illness or other cause must notify immediately the Course Director. The student shall state the reasons for the absence and whether it is likely to be prolonged. Where the absence is for a period of more than five working days, and is caused by illness which may affect their studies, the student shall provide appropriate medical certification in accordance with the General Regulations for Students.

8.3 Students who are absent without good cause for a substantial proportion of classes may be required to discontinue studies, in accordance with the General Regulations for Students.

9 RULES GOVERNING STUDENT CHOICE

9.1 Modules are offered as indicated in the table at section 17. Revisions may be made in accordance with the University's quality assurance procedures. Module availability may vary.

10 EXAMINATION AND ASSESSMENT

10.1 The performance of candidates shall be assessed by the Board of Examiners in accordance with the Regulations Governing Examinations in Programmes of Study.

10.2 Candidates shall be assessed in the modules for which they have enrolled in each year of study. At the discretion of the Board of Examiners candidates may be required to attend a viva voce examination.

- 10.3 Within each module candidates shall be assessed by a combination of coursework and examination in accordance with the attached table.
- 10.4 The pass mark for the module shall be 50%. Where a module is assessed by a combination of coursework and examination a minimum mark of 45% shall be achieved in each element.

11 SUBMISSION OF COURSEWORK

- 11.1 Coursework must be submitted by the dates specified by the Course Committee.
- 11.2 Students may seek prior consent from the Course Committee to submit coursework after the official deadline; such requests must be accompanied by a satisfactory explanation, accompanied in the case of illness by a medical certificate. This application shall be made to the Course Director.
- 11.3 Coursework submitted without consent after the deadline shall not normally be accepted.
- 11.4 Candidates completing a dissertation shall submit a project outline for approval in accordance with the Guidelines for the Preparation of Dissertations for Master's Degree Programmes. Two copies of the dissertation shall be submitted by 30 September (30 April of Year 3 for part-time students) for assessment. The dissertation shall be presented in accordance with the Guidelines for the Presentation of Dissertations for Master's Degree programmes. An electronic version is also required.
- 11.5 Dissertations which achieve a final mark of 70% or above shall be made available for public access through the University Library. Access to such dissertations shall not normally be restricted. Access may be restricted, in exceptional circumstances, for a period of up to two years in the first instance, and for a total period of not more than five years. Such restriction shall be approved in accordance with the procedures described in the Guidelines for the Preparation of Dissertations for Master's Degree programmes. Access to the abstract of the work shall not be restricted. A statement regarding access shall be included in the introduction to dissertations deposited in the Library in accordance with the Guidelines.

12 PROGRESS

- 12.1 Progress from semester 1 to semester 2 is automatic.
- 12.2 Subject to 13 hereof, part-time candidates are required to pass all modules in each year of study in order to proceed to the next.

13 CONSEQUENCES OF FAILURE

- 13.1 Candidates who fail to satisfy the Board of Examiners in assessment may be permitted at the discretion of the Board to re-present themselves as specified in 13.2 for one or more supplementary examination and repeat such coursework or other assessment requirements as shall be prescribed by the Board. Such candidates may be exempted at the discretion of the Board from the normal attendance requirements. Where candidates are required to repeat coursework or to take a supplementary examination the original mark in the failed coursework component or examination shall be replaced by a mark of 50% or

the repeat mark, whichever is the lower for the purpose of calculating the module result.

13.2 In each year, the consequences of failure shall normally be as follows:

Failure in module(s) with an overall value up to and including 60 credit points

Repeat *once only* of specified examination(s) and/or coursework in the failed module(s) (examinations August).

Failure in module(s) with an overall value of more than 60 credit points and less than 90 credit points

Repeat *once only* of specified examination(s) and/or coursework in the failed module(s) in the next academic year (examinations January/May) with or without attendance.

Failure in module(s) with an overall value of 90 credit points or more

Repeat *once only* of specified examination(s) and/or coursework in the failed module(s) in the next academic year with or without attendance, OR withdraw from the programme.

13.3 Candidates who fail the dissertation may be permitted to resubmit the dissertation on one occasion only by 30 April.

14 CLASSIFICATION OF FINAL RESULT

Classification of Final Result for Master's Degrees

14.1 The results of candidates who have successfully completed the Master's degree shall be graded by order of merit as Pass with Distinction and Pass.

14.2 The assessment results for the final level of the programme (Level 7) shall determine the overall grading. The weighting of each module's contribution to the final result shall be determined by the module's credit value.

14.3 The following shall be the minimum overall percentages used to determine the final gradings of candidates:

Pass with Distinction	70%
Pass	50%

14.4 A mark of 70% or above shall also be achieved in the dissertation module in order for the degree to be awarded with Distinction.

14.5 Provided that they have not been exempted for modules amounting to more than 60 credit points, candidates who do not complete the dissertation and have passed the taught modules may be assessed for the award of a Postgraduate Diploma and Certificate in accordance with 14.6.

Classification of Final Result for Postgraduate Diploma and Certificate

14.6 The results of candidates who have successfully completed a programme of study leading to the award of Postgraduate Certificate or Postgraduate Diploma shall be graded by order of merit as Pass with Distinction and Pass.

14.7 The assessment results for the final level of the programme (Level 7) shall determine the overall grading. The weighting of each module's contribution to the final result shall be determined by the module's credit value. (See table at section 17).

14.8 The following shall be the minimum overall percentages used to determine the final gradings of candidates:

Pass with Distinction	70%
Pass	50%

14.9

Provided that they have not been exempted for modules amounting to more than 30 credit points, candidates who fail to satisfy the requirements for the award and have passed appropriate modules shall be assessed for the award of a Postgraduate Certificate.

14.10 Candidates registered on linked postgraduate programmes shall receive only one award at the highest level during a period of continuous registration.

14.11 Candidates admitted with advanced standing shall be assessed in accordance with the programme regulations using the evidence from the accredited prior learning.

15 ILLNESS AND OTHER EXTENUATING CIRCUMSTANCES

15.1 The Board of Examiners may in the case of candidates who are prevented by illness or other sufficient cause from taking or completing the whole or part of the assessment or whose results are substantially affected by illness or other sufficient cause:

- (a) permit the candidate to complete, take, or repeat the examination or coursework or both at an approved subsequent date **or**
- (b) deem the candidate to have passed and recommend an Aegrotat Master's Degree OR Aegrotat Postgraduate Diploma OR Aegrotat Postgraduate Certificate.

15.2 Before an Aegrotat award is recommended a candidate must have indicated that he or she is willing to accept the award.

16 REVISIONS TO REGULATIONS

These regulations may be revised during the student's period of registration in accordance with the procedures approved by Senate.

17.1 PG Cert/ PG Dip/ M Sc in Computing: Contribution of modules to the final award

Year FT/PT	Semester	Level	Module Title	Code	Credit Value	Status Compulsory (c) Optional (o)	Condo nable (Y/N)	Assessment Methods		Contribution to the overall mark of the Final Award
								%Examination	%Coursework	
1/1	1	7	Distributed Systems	COM872J1	15	C	Y	50	50	1/12
1/1	1	7	Software Processes and Process Improvement	COM913J1	15	C	Y	50	50	1/12
1/1	2	7	Reliable Software Development	COM914J2	15	C	Y	50	50	1/12
1/1	2	7	Databases for Structured and Semi-Structured Data	COM915J2	15	C	Y	50	50	1/12
1/2	2	7	Research Methods	COM916J2	15	C	Y	0	100	1/12
1/2	1	7	Mobile and Wireless Networks	COM877J1	15	O	Y	50	50	1/12
1/2	2	7	Autonomic Computing and Communications	COM834J2	15	O	Y	50	50	1/12
1/2	1	7	Advanced Web Technologies	COM835J1	15	O	Y	0	100	1/12
1/2	2	7	E-Business Innovation	COM917J2	15	O	Y	0	100	1/12
1/2	1	7	Intelligent Agents	COM836J1	15	O	Y	50	50	1/12
1/2	2	7	Applied Computational Intelligence	COM837J2	15	O	Y	50	50	1/12
1/2	1	7	Health Informatics	COM838J1	15	O	Y	50	50	1/12
1/2	2	7	Emerging Healthcare Technologies	COM725J2	15	O	Y	0	100	1/12
1 / 2-3	3/ 3-1-2	7	Dissertation*	COM878J4	60	C	N	0	100	1/3

* Indicates module which must be passed at 70% for award of Distinction

* Full-time students complete the dissertation in the 3rd semester of Year 1. Part-time students start the dissertation in the 3rd semester of Year 2 and complete it at the end of the 2nd semester of Year 3.

17.2 PG Dip/ M Sc in Computing (Communications): Contribution of modules to the final award

Year FT/PT	Semester	Level	Module Title	Code	Credit Value	Status Compulsory (c) Optional (o)	Condo nable (Y/N)	Assessment Methods		Contribution to the overall mark of the Final Award
								%Examination	%Coursework	
1/1	1	7	Distributed Systems	COM872J1	15	C	Y	50	50	1/12
1/1	1	7	Software Processes and Process Improvement	COM913J1	15	C	Y	50	50	1/12
1/1	2	7	Reliable Software Development	COM914J2	15	C	Y	50	50	1/12
1/1	2	7	Databases for Structured and Semi-Structured Data	COM915J2	15	C	Y	50	50	1/12
1/2	2	7	Research Methods	COM916J2	15	C	Y	0	100	1/12
1/2	1	7	Mobile and Wireless Networks	COM877J1	15	C	Y	50	50	1/12
1/2	2	7	Autonomic Computing and Communications	COM834J2	15	C	Y	50	50	1/12
1/2	1	7	Advanced Web Technologies	COM835J1	15	O	Y	0	100	1/12
1/2	2	7	E-Business Innovation	COM917J2	15	O	Y	0	100	1/12
1/2	1	7	Intelligent Agents	COM836J1	15	O	Y	50	50	1/12
1/2	2	7	Applied Computational Intelligence	COM837J2	15	O	Y	50	50	1/12
1/2	1	7	Health Informatics	COM838J1	15	O	Y	50	50	1/12
1/2	2	7	Emerging Healthcare Technologies	COM725J2	15	O	Y	0	100	1/12
1 / 2-3	3/ 3-1-2	7	Dissertation*	COM878J4	60	C	N	0	100	1/3

* Indicates module which must be passed at 70% for award of Distinction

* Full-time students complete the dissertation in the 3rd semester of Year 1. Part-time students start the dissertation in the 3rd semester of Year 2 and complete it at the end of the 2nd semester of Year 3.

Normally E-Business Innovation, Applied Computational Intelligence and Emerging Healthcare Technologies are not available in this specialism. However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose one of these instead of a 1st semester option.

17.3 PG Dip/ M Sc in Computing (Web Technology): Contribution of modules to the final award

Year FT/PT	Semester	Level	Module Title	Code	Credit Value	Status Compulsory (c) Optional (o)	Condo nable (Y/N)	Assessment Methods		Contribution to the overall mark of the Final Award
								%Examination	%Coursework	
1/1	1	7	Distributed Systems	COM872J1	15	C	Y	50	50	1/12
1/1	1	7	Software Processes and Process Improvement	COM913J1	15	C	Y	50	50	1/12
1/1	2	7	Reliable Software Development	COM914J2	15	C	Y	50	50	1/12
1/1	2	7	Databases for Structured and Semi-Structured Data	COM915J2	15	C	Y	50	50	1/12
1/2	2	7	Research Methods	COM916J2	15	C	Y	0	100	1/12
1/2	1	7	Mobile and Wireless Networks	COM877J1	15	O	Y	50	50	1/12
1/2	2	7	Autonomic Computing and Communications	COM834J2	15	O	Y	50	50	1/12
1/2	1	7	Advanced Web Technologies	COM835J1	15	C	Y	0	100	1/12
1/2	2	7	E-Business Innovation	COM917J2	15	C	Y	0	100	1/12
1/2	1	7	Intelligent Agents	COM836J1	15	O	Y	50	50	1/12
1/2	2	7	Applied Computational Intelligence	COM837J2	15	O	Y	50	50	1/12
1/2	1	7	Health Informatics	COM838J1	15	O	Y	50	50	1/12
1/2	2	7	Emerging Healthcare Technologies	COM725J2	15	O	Y	0	100	1/12
1 / 2-3	3/ 3-1-2	7	Dissertation*	COM878J4	60	C	N	0	100	1/3

* Indicates module which must be passed at 70% for award of Distinction

* Full-time students complete the dissertation in the 3rd semester of Year 1. Part-time students start the dissertation in the 3rd semester of Year 2 and complete it at the end of the 2nd semester of Year 3.

Normally Autonomic Computing and Communications, Applied Computational Intelligence and Emerging Healthcare Technologies are not available in this specialism. However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose one of these instead of a 1st semester option.

17.4 PG Dip/ M Sc in Computing (Artificial Intelligence): Contribution of modules to the final award

Year FT/PT	Semester	Level	Module Title	Code	Credit Value	Status Compulsory (c) Optional (o)	Condo nable (Y/N)	Assessment Methods		Contribution to the overall mark of the Final Award
								%Examination	%Coursework	
1/1	1	7	Distributed Systems	COM872J1	15	C	Y	50	50	1/12
1/1	1	7	Software Processes and Process Improvement	COM913J1	15	C	Y	50	50	1/12
1/1	2	7	Reliable Software Development	COM914J2	15	C	Y	50	50	1/12
1/1	2	7	Databases for Structured and Semi-Structured Data	COM915J2	15	C	Y	50	50	1/12
1/2	2	7	Research Methods	COM916J2	15	C	Y	0	100	1/12
1/2	1	7	Mobile and Wireless Networks	COM877J1	15	O	Y	50	50	1/12
1/2	2	7	Autonomic Computing and Communications	COM834J2	15	O	Y	50	50	1/12
1/2	1	7	Advanced Web Technologies	COM835J1	15	O	Y	0	100	1/12
1/2	2	7	E-Business Innovation	COM917J2	15	O	Y	0	100	1/12
1/2	1	7	Intelligent Agents	COM836J1	15	C	Y	50	50	1/12
1/2	2	7	Applied Computational Intelligence	COM837J2	15	C	Y	50	50	1/12
1/2	1	7	Health Informatics	COM838J1	15	O	Y	50	50	1/12
1/2	2	7	Emerging Healthcare Technologies	COM725J2	15	O	Y	0	100	1/12
1 / 2-3	3/ 3-1-2	7	Dissertation*	COM878J4	60	C	N	0	100	1/3

* Indicates module which must be passed at 70% for award of Distinction

* Full-time students complete the dissertation in the 3rd semester of Year 1. Part-time students start the dissertation in the 3rd semester of Year 2 and complete it at the end of the 2nd semester of Year 3.

Normally Autonomic Computing and Communications, E-Business Innovation and Emerging Healthcare Technologies are not available in this specialism. However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose one of these instead of a 1st semester option.

17.5 PG Dip/ M Sc in Computing (Health Informatics): Contribution of modules to the final award

Year FT/PT	Semester	Level	Module Title	Code	Credit Value	Status Compulsory (c) Optional (o)	Condo nable (Y/N)	Assessment Methods		Contribution to the overall mark of the Final Award
								%Examination	%Coursework	
1/1	1	7	Distributed Systems	COM872J1	15	C	Y	50	50	1/12
1/1	1	7	Software Processes and Process Improvement	COM913J1	15	C	Y	50	50	1/12
1/1	2	7	Reliable Software Development	COM914J2	15	C	Y	50	50	1/12
1/1	2	7	Databases for Structured and Semi-Structured Data	COM915J2	15	C	Y	50	50	1/12
1/2	2	7	Research Methods	COM916J2	15	C	Y	0	100	1/12
1/2	1	7	Mobile and Wireless Networks	COM877J1	15	O	Y	50	50	1/12
1/2	2	7	Autonomic Computing and Communications	COM834J2	15	O	Y	50	50	1/12
1/2	1	7	Advanced Web Technologies	COM835J1	15	O	Y	0	100	1/12
1/2	2	7	E-Business Innovation	COM917J2	15	O	Y	0	100	1/12
1/2	1	7	Intelligent Agents	COM836J1	15	O	Y	50	50	1/12
1/2	2	7	Applied Computational Intelligence	COM837J2	15	O	Y	50	50	1/12
1/2	1	7	Health Informatics	COM838J1	15	C	Y	50	50	1/12
1/2	2	7	Emerging Healthcare Technologies	COM725J2	15	C	Y	0	100	1/12
1 / 2-3	3/ 3-1-2	7	Dissertation*	COM878J4	60	C	N	0	100	1/3

* Indicates module which must be passed at 70% for award of Distinction

* Full-time students complete the dissertation in the 3rd semester of Year 1. Part-time students start the dissertation in the 3rd semester of Year 2 and complete it at the end of the 2nd semester of Year 3.

Normally Autonomic Computing and Communications, E-Business Innovation, and Applied Computational Intelligence are not available in this specialism. However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose one of these instead of a 1st semester option.

B4: Course Structure

PG Cert in Computing comprises four taught modules -- Software Processes and Process Improvement, Distributed Systems, Reliable Software Development and Databases for Structured and Semi-Structured Data – which constitute the software engineering core of all courses. **PG Dip in Computing** requires one further compulsory module, COM916J2 Research Methods, and three optional modules. **PG Dip in Computing (*with specialism*)** courses comprise seven compulsory modules – the four core software engineering modules, COM916J2 Research Methods and two specialist modules – and one optional module which is from another specialism.

Part-time students complete **PG Cert in Computing** in one year (two semesters), **PG Dip in Computing (*with or without specialism*)** in two years (four semesters) and the M Sc dissertation in two semesters during the third year of study. Full-time students complete **PG Dip in Computing (*with or without specialism*)** in two semesters and the M Sc Dissertation in the third semester, thus completing the M Sc in 12 months. A full-time student who has completed the four core modules in two semesters of study but failed to complete eight modules required for PG Dip would qualify for the award of PG Cert in Computing.

The modules comprising the course are listed in section 12 of the corresponding Programme Specification. The schedule of work for full-time and part-time students is given in tables B4.1-B4.10 below.

B 4.1 PG Cert/ PG Dip/ M Sc in Computing

All modules except Dissertation are worth 15 credit points. (COM874J4 Dissertation is worth 60 credits.) Unless otherwise indicated, all modules are at level 7. Current, Revised and New modules are indicated in the structure diagram.

Semester 1 Options

COM877J1 Mobile and Wireless Networks (R)

COM835J1 Advanced Web Technologies (N)

COM836J1 Intelligent Agents (N)

COM838J1 Health Informatics (N)

Semester 2 Options

COM834J2 Autonomic Computing and Communications (R)

COM917J2 E-Business Innovation (R)

COM837J2 Applied Computational Intelligence (N)

COM725J2 Emerging Healthcare Technologies (C)

	Semester 1	Semester 2	Semester 3
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)	COM878J4 Dissertation (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)	
	Option1	COM916J2 Research Methods (R)	
	Option 2	Option 3	

Table B4.1: Schedule of work for full-time M Sc in Computing

	Semester 1	Semester 2
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)
Year 2	Option 1	COM916J2 Research Methods (R)
	Option 2	Option 3
Year 3	COM878J4 Dissertation (R)	COM878J4 Dissertation (R)

Table B4.2: Schedule of work for part-time M Sc in Computing

B 4.2 PG Dip/ M Sc in Computing (Communications)

All modules except Dissertation are worth 15 credit points. (COM874J4 Dissertation is worth 60 credits.) Unless otherwise indicated, all modules are at level 7. Current, Revised and New modules are indicated in the structure diagram.

Semester 1 Options

COM835J1 Advanced Web Technologies

COM836J1 Intelligent Agents (N)

COM838J1 Health Informatics (N)

Semester 2 Options

Normally there are no options in the 2nd semester. However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose from the following:

COM917J2 E-Business Innovation (R)

COM837J2 Applied Computational Intelligence (N)

COM725J2 Emerging Healthcare Technologies (C)

	Semester 1	Semester 2	Semester 3
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)	COM878J4 Dissertation (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)	
	COM877J1 Mobile and Wireless Networks (R)	COM916J2 Research Methods (R)	
	Option 1	COM834J2 Autonomic Computing and Communications (R)	

Table B4.3: Schedule of work for full-time M Sc in Computing (Communications)

	Semester 1	Semester 2
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)
Year 2	COM877J1 Mobile and Wireless Networks (R)	COM916J2 Research Methods (R)
	Option 1	COM834J2 Autonomic Computing and Communications (R)
Year 3	COM878J4 Dissertation (R)	COM878J4 Dissertation (R)

Table B4.4: Schedule of work for part-time M Sc in Computing (Communications)

B 4.3 PG Dip/ M Sc in Computing (Web Technology)

All modules except Dissertation are worth 15 credit points. (COM874J4 Dissertation is worth 60 credits.) Unless otherwise indicated, all modules are at level 7. Current, Revised and New modules are indicated in the structure diagram.

Semester 1 Options

COM877J1 Mobile and Wireless Networks (R)

COM836J1 Intelligent Agents (N)

COM838J1 Health Informatics (N)

Semester 2 Options

Normally there are no options in the 2nd semester. However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose from the following:

COM834J2 Autonomic Computing and Communications (R)

COM837J2 Applied Computational Intelligence (N)

COM725J2 Emerging Healthcare Technologies (C)

	Semester 1	Semester 2	Semester 3
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)	COM878J4 Dissertation (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)	
	COM835J1 Advanced Web Technologies (N)	COM916J2 Research Methods (R)	
	Option 1	COM917J2 E-Business Innovation (R)	

Table B4.5: Schedule of work for full-time M Sc in Computing (Web Technology)

	Semester 1	Semester 2
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)
Year 2	COM835J1 Advanced Web Technologies (N)	COM916J2 Research Methods (R)
	Option 1	COM917J2 E-Business Innovation (R)
Year 3	COM878J4 Dissertation (R)	COM878J4 Dissertation (R)

Table B4.6: Schedule of work for part-time M Sc in Computing (Web Technology)

B 4.4 PG Dip/ M Sc in Computing (Artificial Intelligence)

All modules except Dissertation are worth 15 credit points. (COM874J4 Dissertation is worth 60 credits.) Unless otherwise indicated, all modules are at level 7. Current, Revised and New modules are indicated in the structure diagram.

Semester 1 Options

COM877J1 Mobile and Wireless Networks (R)

COM835J1 Advanced Web Technologies (N)

COM838J1 Health Informatics (N)

Semester 2 Options

Normally there are no options in the 2nd semester. However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose from the following:

COM834J2 Autonomic Computing and Communications (R)

COM917J2 E-Business Innovation (R)

COM725J2 Emerging Healthcare Technologies (C)

	Semester 1	Semester 2	Semester 3
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)	COM878J4 Dissertation (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)	
	COM836J1 Intelligent Agents (N)	COM916J2 Research Methods (R)	
	Option 1	COM837J2 Applied Computational Intelligence (N)	

Table B4.7: Schedule of work for full-time M Sc in Computing (Artificial Intelligence)

	Semester 1	Semester 2
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)
Year 2	COM836J1 Intelligent Agents (N)	COM916J2 Research Methods (R)
	Option 1	COM837J2 Applied Computational Intelligence (N)
Year 3	COM878J4 Dissertation (R)	COM878J4 Dissertation (R)

Table B4.8: Schedule of work for part-time M Sc in Computing (Artificial Intelligence)

B 4.5 PG Dip/ M Sc in Computing (Health Informatics)

Semester 1 Options

All modules except Dissertation are worth 15 credit points. (COM874J4 Dissertation is worth 60 credits.) Unless otherwise indicated, all modules are at level 7. Current, Revised and New modules are indicated in the structure diagram.

COM877J1 Mobile and Wireless Networks (R)

COM835J1 Advanced Web Technologies (N)

COM836J1 Intelligent Agents (N)

Semester 2 Options

Normally there are no options in the 2nd semester. However, a student who is exempt from one or more 2nd semester modules because of credits earned elsewhere may choose from the following:

COM834J2 Autonomic Computing and Communications (R)

COM917J2 E-Business Innovation (R)

COM837J2 Applied Computational Intelligence (N)

	Semester 1	Semester 2	Semester 3
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)	COM878J4 Dissertation (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)	
	COM838J1 Health Informatics (N)	COM916J2 Research Methods (R)	
	Option 1	COM725J2 Emerging Healthcare Technologies (R)	

Table B4.9: Schedule of work for full-time M Sc in Computing (Health Informatics)

	Semester 1	Semester 2
Year 1	COM913J1 Software Processes and Process Improvement (R)	COM914J2 Reliable Software Development (R)
	COM872J1 Distributed Systems (R)	COM915J2 Databases for Structured and Semi-Structured Data (R)
Year 2	COM838J1 Health Informatics (N)	COM916J2 Research Methods (R)
	Option 1	COM725J2 Emerging Healthcare Technologies (R)
Year 3	COM878J4 Dissertation (R)	COM878J4 Dissertation (R)

Table B4.10: Schedule of work for part-time M Sc in Computing (Health Informatics)

MODULE TITLE:	Distributed Systems	
MODULE CODE:	COM872J1	
DATE OF REVISION:	2006/7	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory	
SEMESTER:	1	
LOCATION:	Jordanstown.	
E-LEARNING:	Web supplemented	
PREREQUISITE(S):	None	
CO-REQUISITE(S):	None	
MODULE CO-ORDINATOR(S):	Shapcott, C.M.	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY:	Shapcott, C.M.	
HOURS:		
	Lectures	27 hrs
	Seminars	3 hrs
	Tutorials	3 hrs
	Practicals	3 hrs
	Independent study (including assessment)	114 hrs
TOTAL EFFORT HOURS:	150	
ACADEMIC SUBJECT:	COM	

RATIONALE
 With mobile computing and broad-band internet technology now commonplace software engineers must be able to design and develop distributed systems on a routine basis. This module introduces the theory of distributed systems and the software components that are used to develop such systems. These include internet protocols such as TCP/IP, client-server systems and more recent technologies such as distributed objects and web services.

AIMS
 To provide a thorough grounding in the theory and practice of distributed systems.

LEARNING OUTCOMES

A successful student will be able to show that he/she:

KNOWLEDGE AND UNDERSTANDING

- K1 Can characterise distributed systems and models of interaction, failure and security
- K2 Understands the layered protocols that underpin internet-based client-server systems
- K3 Understands various distributed algorithms associated with time, coordination and transaction management
- K4 Understands the various software technologies used to create distributed systems.

INTELLECTUAL QUALITIES

- I1 Is able to describe and model real-world problems involving distributed systems.
- I2 Can conceptualise design solutions to problems related to distributed systems.
- I3 Can evaluate and apply current research and best practice in distributed systems
- I4 Can apply the theory of distributed systems to various problems

PROFESSIONAL/PRACTICAL SKILLS

- P1 Can critically evaluate the state of the art in distributed systems.
- P2 Can specify problem requiring a multi-tier distributed system as its solution
- P3 Is able to implement a distributed system using a variety of application frameworks
- P4 Is able to evaluate a distributed system.
- P5 Can describe and report on distributed systems.

TRANSFERABLE SKILLS

- T1 Is able to assess complex problems using the relevant professional sources
- T2 Can design one or more solutions to a complex problem
- T3 Can write a written report evaluating the state of the art of distributed systems.

CONTENT

Distributed Systems

Fundamental characteristics: components on networked computers sharing state and coordinating activities. Transparency, interoperability, scalability, failure-handling, security. Processes, concurrency and synchronisation.

Underpinning Technology – Protocol Layers and Internet Technology

TCP/IP protocols for communications between processes. Services offered by internet and transport layers. TCP and UDP. The socket abstraction. Web protocols. XML.

Algorithms for Distributed Systems

Time and global states, coordination and agreement, name services.

Client-Server Programming

The request-reply paradigm. Multithreading, state, connection handling. Multi-tiered services: servlets and database connectivity.

Distributed Transactions and Concurrency Control

The ACID principle. Flat and nested distributed transactions. Commit protocols. Deadlock and recovery.

Distributed Services

Remote objects and remote method invocations. Common Object Request Broker Architecture. Xml-based services: SOAP, web services.

Java-Based Distributed Systems

The Java language will be used to give practical applications of the technology.

TEACHING AND LEARNING METHODS

Lectures will be used to convey theory and practice.

Seminars will give students the opportunity to explore issues in more depth.

Tutorials will provide problem-solving opportunities.

Practical exercises will enable students to run distributed systems on local area networks using the Java language.

Students will be directed to read various papers and the textbook.

The module is web-supplemented. Material is available on a web-site.

ASSESSMENT

Coursework 1

Percentage contribution: 40% of coursework

Students are asked to survey the literature in a particular field of distributed systems, for example that of benchmarking distributed systems.

This assignment will measure the student's achievement of module learning outcomes :K2, K4, I3, P1, T1

Coursework 2

Percentage contribution: 60% of coursework

Students implement a working program which illustrates some aspect of the field used in Coursework 1, for example they might be asked to create a simple benchmark for a distributed system.

This assignment will measure the student's achievement of module learning outcomes :I2, I3, I4, P2, P3, P4, P5, T2, T3

Examination

Percentage contribution: 50%

Students will be asked to answer three questions out of five in a two-hour examination.

The examination will be closed-book.

Learning outcome K1, K2, K3, K4 and I1, I2 and I4 will be assessed.

50% Coursework

50% Examination

READING LIST

Required

George Coulouris, Jean Dollimore, Tim Kindberg, 2005, Distributed systems: concepts and design. Harlow. Addison-Wesley.

Recommended

Brose, Gerald. 2001, Java programming with CORBA : advanced techniques for building distributed a. - 3rd ed. - New York; Chichester : Wiley.

Comer, Douglas, 1996, Internetworking with TCP/IP Vol.1 : Principles, protocols, and architecture. - 4th ed. - Upper Saddle River, N.J. : Prentice Hall; London : Prentice-Hall.

Farley, Jim, 1998, Java distributed computing / Jim Farley. - Cambridge : O'Reilly.

Greenwich, CT, 1999, Java network programming : a complete guide to networking, streams, and dist. 2nd ed. - : Manning.

Harold, Elliotte Rusty, 2000, Java network programming. - 2nd ed. - Sebastopol, CA. : O'Reilly & Associates.

Mahmoud, Qusay H., 2000, . Distributed programming with Java, Greenwich, CT : Manning.

Mullender, Sape (Editor), 1993, Distributed Systems (ACM Press S.).

Tanenbaum, Andrew S., Martin van Steen, 2003, Distributed Systems (International Edition) Prentice Hall.

SUMMARY DESCRIPTION

With mobile computing and broad-band internet technology now commonplace software engineers must be able to design and develop distributed systems on a routine basis. This module introduces the theory of distributed systems and the software components that are used to develop such systems. These include internet protocols such as TCP/IP, client-server systems and more recent technologies such as distributed objects and web services.

Module Title	Software Processes and Process Improvement		
Module Code	COM913J1 (CRN: 3025)		
Module Level	7		
Credit Points	15		
Semester	1		
Module Status	Core		
Location	Jordanstown		
Prerequisite(s)	None		
Corequisite(s)			
Module Coordinator			
Teaching Staff Responsible	Dr F.G.Wilkie	C&M	Jordanstown
Hours	Lectures/Seminars	24 hours	
	Tutorial	12 hours	
	Independent study	114 hours	
	Total Hours	150 hours	
Academic Topic	Computing		

Rationale

This module focuses on the processes employed in software development and structures for Software Process Improvement (SPI). With the increasing globalisation of software development, software processes are fast becoming an important topic – providing a mechanism for the common understanding and operation of many software development tasks either within one site or across geographically split sites. With processes, comes the need to understand performance and improve operations to gain and maintain competitive advantage. This module is concerned with software engineering processes including agile methods and techniques and models for both planning and monitoring process improvements.

Aims

1. to develop the student's knowledge of modern software development processes including those for Agile methods
2. to equip the student with knowledge of software process improvement in general and model-based process improvement in particular
3. to require the student to apply software process improvement practice to selected problems
4. to foster a co-operative environment for exchange of ideas amongst students with respect to understanding software processes and process improvement

Learning Outcomes

A successful student will be able to show that he/she can:

KNOWLEDGE AND UNDERSTANDING

- | | |
|----|---|
| K1 | Explain fundamental concepts, principles, theories and practices underlying software process improvement as an academic discipline and as a business and industrial tool. |
|----|---|

INTELLECTUAL QUALITIES

- | | |
|----|--|
| I1 | Abstract and model data and facts pertaining to the improvement of processes for the purposes of comprehension, analysis, specification and communication. |
| I2 | Analyze and evaluate the extent to which mature software processes can help organisations. |
| I3 | Relate professional, legal, moral and ethical issues to processes and process improvement within organisations |
| I4 | Formalise and articulate a logical argument for the promotion of a process culture and process improvement |

PROFESSIONAL/PRACTICAL SKILLS

- | | |
|----|---|
| P1 | Specify complex software engineering processes. |
| P2 | Use process models to analyse the root causes of process problems. |
| P3 | Apply software process improvement principles to the design of an improvement plan. |
| P4 | Evaluate real-world software development practices against a process improvement model. |
| P5 | Communicate, effectively, technical information to technical, management, user, and academic audiences. |

TRANSFERABLE SKILLS

- | | |
|----|--|
| T1 | Assess complex software engineering environments, abstracting information from a process model in order to arrive at an informed judgement about the strengths and weaknesses of that environment. |
|----|--|

- T2 Design appropriate process improvement solutions to address identified weaknesses.
- T3 Apply numeracy in both understanding and presenting cases involving a quantitative aspect .
- T4 Manage one's own learning and development including time management, organizational skills and awareness of entrepreneurship issues.

Content

Underlying theory of Process Management, drawing on experience in the manufacturing industries.

Key development issues for the software industry and why process improvement is important.

The driving forces behind process improvement (Customer, product, management, developer and model-driven).

High-level lifecycle processes including Agile approaches.

The nature and importance of Institutionalization in improving processes using a process improvement model.

Exemplar detailed processes. How they relate to an improvement model and evaluating them against such a model.

Making change happen – facilitating improvement.

Monitoring process performance and improvements using measurement frameworks such as Six-Sigma and the Balanced Score Card.

The future of process management – research directions from the International Process Research Consortium.

Learning and Teaching Methods

Lectures will present core module material, using worked examples as appropriate.

Tutorials, based on improvement models, will be used to study core module material through both individual and group-based activities and will help students explore issues in more depth.

Practical exercises will support and build upon the lecture and tutorial content.

Directed reading will consolidate student's understanding of new material via books and online sources.

Guest Lectures from industry will supplement the content with real-world experience.

Assessment.	
Coursework Assignments	50%
Written Examination	50%
Course work	
Course work 1: (50%) (15 hours)	
This assignment will be concerned with consolidating material learnt through lectures and developing the student's ability to reason about the content and structure of a software process model whilst exploring relevant additional material.	
This assignment will measure the student's achievement of learning outcomes K1, I3, I4, P5, T4 for the module.	
Course work 2: (50%) (15 hours)	
This assignment will be concerned with consolidating material learnt through lectures and developing the student's ability to apply an improvement model to an exemplar process in order to create an improvement programme or to better understand the complexities of model application.	
This assignment will measure the student's achievement of learning outcomes K1, I1, I2, I4, P1, P2, P3, P4, P5 T1, T2, T4 for the module.	
Examination:	
The examination will consist of one two-hour paper. Students will be offered a choice of questions. Questions will draw on ideas and themes presented across the module. Typically, questions will require students to demonstrate understanding across the module topics and be able to apply strategies and techniques to given case studies.	
The examination will measure the student's achievement of learning outcomes K1, I1, I2, I3, P1, P4, T1, T2, T3 for the module.	

Reading List.
Strongly Recommended
1. Kulpa M.K. & Johnson, K.A. 2008. <i>Interpreting the CMMI: A Process Improvement Approach</i> . 2 nd edition. Auerbach.
Indicative
1. Chrissis, M.B., Konrad, M., & Shrum, S. 2007. <i>CMMI: Guidelines for Process Integration and Product Improvement</i> , 2 nd Edition. Boston: Addison-Wesley.
2. Kniberg H. 2007. <i>SCRUM and XP from the trenches</i> , InfoQ books, C4Media Inc, ISBN: 978-1-4303-2264-1.
3. Van Loon, H. 2004. <i>Process Assessment and ISO/IEC 15504: A Reference Book</i> , Springer, ISBN 0387231722, 9780387231723.

Background Reading

1. Pressman, R.S. & Ince, D. 2000. *Software Engineering: A Practitioner's Approach* European Adaptation, London: McGraw-Hill.
2. Sommerville I. 2006. *Software Engineering*. Boston: Addison Wesley.
3. Stamatis, D.H. 2004. *Six Sigma Fundamentals*. New York: Productivity Press.
4. George, M.L., Rowlands, D.T and Kastle, W. 2003, *What is Lean Six Sigma*, McGraw-Hill, ISBN 0-07-142668-X, 978-0071426688

Summary Description

This module covers software processes from high level process lifecycle frameworks including agile methods through to some detailed exemplar processes that provide opportunities for mapping from model-based process improvement approaches. Students learn how to map real-world software development practices onto a process framework and how to use this as a tool for identifying areas for improvement.

MODULE TITLE: Reliable Software Development

MODULE CODE: COM914J2 (CRN: 3026)

DATE OF REVISION: 2007/08

MODULE LEVEL: 7

CREDIT POINTS: 15

MODULE STATUS: Compulsory

SEMESTER: 2

LOCATION: Jordanstown.

E-LEARNING: Web supplemented

PREREQUISITE(S): None

CO-REQUISITE(S): None

MODULE CO-ORDINATOR(S): Augusto, JC.

TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY: Augusto, JC.

HOURS:

Lectures 18 hrs

Seminars 0 hrs

Tutorials 0 hrs

Practicals 18 hrs

Independent study
(including assessment) 114 hrs

TOTAL EFFORT HOURS: 150 hours

ACADEMIC SUBJECT: COM

RATIONALE

Software production is an error prone activity and together with the increasing dependency of society on computing systems there is also an increasing need for a way to produce more reliable software. This module will focus on methods which have been developed in the area of Software Engineering to facilitate the development of better quality software.

These techniques are applied through many phases of the software lifecycle and in different ways by different development teams. Whether design, implementation, testing, verification and validation are applied more iteratively and progressively or more sequentially, software developers need to be aware of advances in these techniques and methodologies that can increase the confidence in the behaviour of a software product.

More classical stages of the development process will be covered with less scope to provide an opportunity for exploring new techniques and tools which are revolutionary in the analysis of systems behaviour. The module will start by covering the importance of Requirements and Testing. This will motivate the use of the complementary methodology of Verification. After covering techniques to investigate the extent of success in building software that works well, the element of Validation is introduced to focus on the problem of verifying the alignment of the final product with the product that was initially requested.

This module will emphasize the use of tools to support the methodologies to be covered.

AIMS

This module will introduce the students to methods and tools developed in the area of Software Engineering to increase the reliability of software. Students will learn about the motivations for these methods and tools and will use these to exercise the concepts learnt through the implementation of software projects of adequate complexity.

LEARNING OUTCOMES

A successful student will be able to show that he/she can:

KNOWLEDGE AND UNDERSTANDING

- K1 Articulate the motivations behind the use of different methods in Software Engineering design to support the development of software.
- K2 Articulate the main concepts making possible the use of Software Engineering methods and associated tools to increase software reliability.
- K3 Identify aspects of software systems where tools for the analysis of correct software can be used.

INTELLECTUAL QUALITIES

- I1 Analyse software with the help of the tools considered.
- I2 Assess pros and cons of different methods and tools.

PROFESSIONAL/PRACTICAL SKILLS

- P1 Apply methods for software reliability analysis.
- P2 Use tools to improve software under analysis.
- P3 Reflect on the professional/ethical responsibilities of the software developing team.

TRANSFERABLE SKILLS

- | | |
|----|--|
| T1 | Recognize how the methods and tools can be used in a range of different areas of Computer Science (e.g., e-commerce and underlying technologies like distributed systems and networks) |
| T2 | Apply the criteria for selecting different methods and tools according to the characteristics of a problem |

CONTENT

Motivations behind the use of methodologies and tools for the production of software. Important examples of system failures. Lessons learnt. Complex real-world applications developed with assistance of formal methods.

The software lifecycle. Different strategies for software development. Gathering requirements and testing.

Verification. Model Checking – fundamentals; specification of behavioral properties (e.g. reachability, safety, liveness, deadlock-freeness and fairness); tools; applications. The SPIN Model Checker – design abstraction; modelling systems with Promela; modelling processes, messages and channels; defining correctness claims; simulation and verification. Latest advances in verification.

Validation and user satisfaction. Connection with early stages of the software lifecycle.

The professional/ethical responsibilities of the software developing team with regards to the production of unreliable software and its consequences.

TEACHING AND LEARNING METHODS

Lectures will introduce the main technical components of the module, with illustrative examples and demos to present the fundamental concepts behind this technology.

Practical exercises will enable the students to develop their skills in identifying critical aspects of software systems to be explored and to use tools to analyse such systems at different stages of the system development.

Students will be directed to read a number of selected research publications, either from conference proceedings or from journals reporting on real-life applications of the methods and tools considered.

Students will be expected to use tools, e.g. SPIN, to model systems and analyse their correctness with respect to a specification by using simulation and verification.

The module is web supplemented to provide students a more flexible interaction and access to the learning resources.

ASSESSMENT

Coursework:

Students will be asked to specify a problem for which they will gather requirements, implement, test, verify and validate. This will be developed in two phases so as to exercise the interaction in between some of the basic stages of the software development. This coursework will be worth 50% of the marks for the module. This assignment will measure the student's achievement of module learning outcomes I1-2, P1-2 and T1-2.

Examination:

The written examination is 2 hours in duration. The paper consists of 5 questions measuring all learning outcomes. Students will be required to answer 3 questions in total.

The examination will measure the student's achievement of learning outcomes K1, K2, K3 **and P3**.

50 % Coursework

50 % Examination

1. READING LIST

Recommended

Berard et al, 2001, "Systems and Software Verification: Model-Checking Techniques and Tools", Berlin, Springer Verlag.

G J Holzman, 2003, "The Spin Model Checker Primer and Reference Manual", Reading, Massachusetts, Addison-Wesley.

G J Holzman, 2002, "The Logic of Bugs", Proceedings of ACM Foundations of Software Engineering (FSE 2002), Charleston SC USA..

Kim G. Larsen, Paul Pettersson, and Wang Yi. 1997, "UPPAAL in a Nutshell", International Journal on Software Tools for Technology Transfer. Number 1-2 pages 134-152.

M. Dwyer, G. Avrunin, and J. Corbett , 1999, "Patterns in property specifications for finite-state verification" in Proceedings of 21st International Conference on Software Engineering, ICSE99, Los Angeles, May 1999.

Neil Storey, 1996, "Safety-critical computer systems", Reading, Massachusetts, Addison-Wesley.

Nancy G. Leveson, 1995, "System safety and computers", Reading, Massachusetts, Addison-Wesley.

Elizabeth Hull, Ken Jackson and Jeremy Dick, 2004, "Requirements Engineering", Berlin, Springer.

I Sommerville , 2006, "Software Engineering" (8th Ed), ", Reading, Massachusetts, Addison-Wesley.

R Craig and SP Jaskiel, 2002, "Systematic Software Testing", Artech House.

C Kaner, J Bach and B Pettichord, 2002, "Lessons Learned in Software Testing: A Context-Driven Approach", Wiley Europe.

SUMMARY DESCRIPTION

This module focuses on methods and tools which have been developed to facilitate the representation of software systems, the simulation of their behaviour and the verification that essential desirable (undesirable) behavioural properties are present (absent respectively).

These methods and tools foster early detection of key processes, problems and the understanding of subtle interactions within software systems.

This module will be particularly focused on the exploration of such methods and especially on the use of tools, for example SPIN and UPPAAL, which can provide automatic analysis of systems and are used nowadays by companies during the software process in real-life problems.

Students will be encouraged to learn general fundamental notions these methods and tools are based on, to experiment with the use of the tools and to research and reflect on the possible applications of these technologies.

The consequences of unreliable software and the role of software developing teams in the negative consequences that faulty software can bring to society will be also discussed and considered as part of basic education for needed for the formation of more responsible professionals.

MODULE TITLE:	Databases for Structured and Semi-Structured Data	
	Short Title: Structured/Semi-Structured Databases	
MODULE CODE:	COM915J2 (CRN 3027)	
DATE OF REVISION	2008/9	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS	Compulsory	
SEMESTER:	2	
LOCATION:	Jordanstown	
E LEARNING	Web supplemented	
PREREQUISITE(S)	None	
CO-REQUISITE(S)	None	
MODULE CO-ORDINATOR(S):	Ojha, PC	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY	Ojha, PC	
HOURS	Lectures	24 hrs
	Seminars	0 hrs
	Tutorials	0 hrs
	Practicals	12 hrs
	Independent study (including assessment)	114 hrs
TOTAL EFFORT HOURS:	150	
ACADEMIC SUBJECT:	COM	

RATIONALE

The relational model has been the *de facto* standard for databases for over twenty-five years because it supports complex, *ad hoc* queries, albeit for simply structured data. Although it is still the dominant model, it has been recognised for some time that many applications need to store and query complex structured objects. The object-relational model achieves this by extending the relational model to include objects. More recently, there has been much interest and activity in the use of XML for data exchange and for storing semi-structured data.

It is imperative that a computing professional is well-versed in the theory and practice of these developments.

AIMS

To provide deep theoretical and practical knowledge of relational, object-relational and XML databases.

LEARNING OUTCOMES

A successful student will be able to show that he/she can :

KNOWLEDGE AND UNDERSTANDING

- K1 explain the mathematical theory that underpins relational databases;
- K2 articulate the reasons for the drive towards object-relational, object and XML databases;
- K3 explain the computing concepts that are relevant to relational, object-relational and XML databases;
- K4 explain the techniques for securing data and the importance of data security in light of the UK Data Protection Act;

INTELLECTUAL QUALITIES

- I1 abstract and model real-world data management problems in terms of database concepts;
- I2 conceptualize original design solutions to problems of data management;
- I3 reason critically in the area of databases;
- I4 critically evaluate various data models and designs and implementations of databases;

PROFESSIONAL/PRACTICAL SKILLS

- P1 design a well-normalised relational database from semantically-obvious functional dependencies;
- P2 design, implement and query an object-relational database;
- P3 design, implement and query an XML database;

TRANSFERABLE/KEY SKILLS

- T1 manage his/her own learning and professional development.

CONTENT

Relational Databases

Theory of relational databases: functional dependencies; Armstrong's axioms; normal forms; attribute preservation, dependency preservation and non-additive joins in relational decomposition; algorithms for schema design.

JDBC API for Java access to relational databases.

Object-Relational Databases

Four quadrant classification of database applications; characteristic features of Object-Relational Database Management Systems: Support for extensible base-data types, complex objects, inheritance and rules; Oracle as an exemplar Object-Relational Database Management System.

Database Security

UK Data Protection Act and its implications for computerised databases; Security and Authorization in SQL; Encryption and authentication.

XML Databases

XML for data exchange; Structure of XML data; Document Type Definition and XML Schema; Querying and transformation of XML data: XSLT, XPath and XQuery; XML-enabled and native XML data stores; Oracle as an exemplar XML-enabled database.

TEACHING AND LEARNING METHODS

Lectures will be used to present the main theoretical ideas and practical methods (K1-K4, P1-P3).

Practical exercises will be used to develop practical expertise in the design, implementation and use of XML-enabled and object or object-relational databases (K3, I1, I2, P2, P3, T1).

Students will be directed to selectively read the relevant material from a range of advanced textbooks (K1-K3, I1-I4, P1-P3, T1).

Students will be expected to supplement their directed reading with other sources in the professional and research literature (K4, I3, T1).

The module is web-supplemented.

Coursework 1:

Students will be asked to design and implement a relational/object-relational database with an industry-standard database management system.

Learning outcomes assessed: K3, I1 - I4, P2, T1.

Coursework 2:

Students will be asked to (i) consider the implications of the Data Protection Act, (ii) extend a relational/object-relational database to include XML features.

Learning outcomes assessed: K3, K4, I1 – I4, P3, T1.

Examination:

A two-hour paper with between 3 and 5 questions in which there will be an element of choice.

Learning outcomes assessed: K1 – K3, I1 – I4, P1 -- P3, T1.

50% Coursework

50% Examination

READING LIST

Required

Silberschatz, A, Korth, HF and Sudarshan , S, 2002, *Database System Concepts*, 4th Edition, McGraw Hill, New York.

Recommended

Chaudhri, AB, Rashid, A and Zicari, R (Eds), *XML Data Management: Native XML and XML-Enabled Database Systems*

Elmasri, R and Navathe, SB, 2000, *Fundamentals of Database Systems*, 3rd Edition, Addison-Wesley, New York.

Garcia-Molina H, Ullman JD and Widom J, 2009, *Database Systems, The Complete Book, 2nd Edition*, Pearson Education Inc., New Jersey.

Stonebraker, M, Brown, P and Moore, D, 1998, *Object-relational DBMSs*, Morgan Kaufman.

Sunderraman, R, 2004, *Oracle 9i Programming: A Primer*, Pearson/Addison-Wesley, New York..

Ullman, JD, 1982, *Principles of Database Systems*, Computer Science Press.

SUMMARY DESCRIPTION

This module addresses the advanced theory and practice of relational, object-relational, object and XML databases.

MODULE TITLE:	Research Methods	
MODULE CODE:	COM916J2 (CRN: 3028)	
DATE OF REVISION:	2008/9	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory	
SEMESTER:	2	
LOCATION:	Jordanstown.	
E-LEARNING:	Web-supplemented	
PREREQUISITE(S):	None	
CO-REQUISITE(S):	None	
MODULE CO-ORDINATOR(S):	Lundy, PJ	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY:	Lundy, PJ	
HOURS:		
	Lectures	12 hrs
	Seminars	4 hrs
	Tutorials	0 hrs
	Practicals	20 hrs
	Independent study (including assessment)	114 hrs
TOTAL EFFORT HOURS:	150	
ACADEMIC SUBJECT:	COM	

RATIONALE

There is a need to complement and expand skills in research practices and management acquired during undergraduate courses.

Job markets (e.g. industry, government and universities) require graduates with solid skills in formulating, implementing, evaluating or managing research-driven projects.

In response to European and national objectives and requirements, there is a need to support the development of research skills for graduate students.

A more solid scholarly profile may motivate and facilitate the participation of postgraduate students in other research-oriented training courses e.g. Ph.D.

Due to the diversity and complexity of technological and ethical issues relating to research implementation and management, it is crucial to support the formation of better informed, more critical and scientifically-minded graduate students.

AIMS

1. To provide the foundations of good scientific practice.
2. To introduce students to fundamental problems, principles, approaches and tools for designing and managing research.
3. To provide students with fundamental skills required for evaluating the outcomes of empirical research.
4. To aid students in the formulation and implementation of their M.Sc. dissertations.
5. To enhance the understanding of ethical and societal concerns related to scientific research and technology development, as well as of the identification of ethical problems and options for addressing them.
6. To improve technical and scientific communication skills.

LEARNING OUTCOMES

A successful student will be able to show that he/she:

KNOWLEDGE AND UNDERSTANDING

- | | |
|----|---|
| K1 | Understands the basic research skills required for completing an informatics research project. |
| K2 | Understands key processes involved in managing, reporting and assessing scientific research. |
| K3 | Understand the legal, professional, social and ethical issues involved in informatics research. |
| K4 | Can identify research management and ethical problems, as well as options for tackling them. |

INTELLECTUAL QUALITIES

- I1 Understands the basic principles for formulating, conducting and evaluating a research problem in computer science.
- I2 Has acquired fundamental skills and techniques for critically assessing research outcomes reported in the scientific literature.
- I3 Understands scientific and professional integrity in computer science.

PROFESSIONAL/PRACTICAL SKILLS

- P1 Can conduct an ethical review of a research proposal.
- P2 Can review scholarly literature to support the formulation, design and evaluation of a research project.
- P3 Can propose a research project

TRANSFERABLE SKILLS

- T1 Can communicate research, including writing, group discussion and oral presentations.
- T2 Has the skills required for identifying problems, identifying research and development resources, gathering and analysing information, defining project requirements and objectives, and project design and management.
- T3 Has enhanced interpersonal and management skills, including group cooperation, critical discussions, decision making, risk management, dealing with legal, ethical and professional concerns, setting and meeting deadlines.

CONTENT

1. Foundations of research in computer science:

Scientific Method. Research in Computing
Computer science research vs. software development.
The Research processes: Project formulation, design, management, peer-review and communication. The MSc Dissertation Structure.

2. Identification of research resources and information gathering

Introduction to the use of libraries and e-resources.
Literature-based information gathering.
Open access publishing

3. Formulating and developing a research project

Creative and critical thinking, problem solving.
Conducting a literature review.
Evaluating current advances and gaps in a particular area.
Identifying goals, objectives, plans, tools, outcomes.

4. Free and Open Source Software (FOSS)

Origins of the Open Source movement.
The Open Source Business Model
Copyright, Licenses and Software Patents.
Influence on Society of the Open Source movement.
Open Source software at UU.

5. Reporting research, the peer-review process and research funding

Abstracts, Posters, Conference and Journal papers.
The review and publication process. Grants and research proposals.
Dissemination and commercialisation of research: Authorship, intellectual property rights and systems, including patents

6. Legal, Professional, Societal and Ethical issues

Legal issues in Computing. Professionalism and Professional Codes of Practice.
Plagiarism. Identification of ethical problems or conflicts, possible actions to address them. Working with human subjects: privacy and confidentiality, health and safety issues.

TEACHING AND LEARNING METHODS

Lectures will be used to introduce and discuss main concepts, techniques and examples relevant to the content. Presentations will be delivered by invited speakers on topics such as Research Resources and Information Gathering, Scientific Method, Free and Open Source Software, etc.

Seminars will consist of presentations and discussions on different research projects and experiences from invited speakers. The lecturer will define guidelines for discussing the projects in the classroom. This will allow the students to assess the application of research skills and to analyse research project cases in different areas.

Independent study will comprise assignments and exercises relating to ethical review, comparing the Dissertation and Commercial processes, including Legal, Professional, Social and Ethical issues, making a research proposal and conducting a literature review.

The module is web-supplemented.

READING LIST

Required

1. The lecturer will provide the students with guidelines for the selection of papers or other materials required for the completion of practical exercises and assignments.
2. The lecturer will provide the students with papers or other documentation required to develop skills or understand problems and techniques.

Recommended

C. Hart, 2004, *Doing Your Masters Dissertation* (Essential Study Skills S.), Sage Publications Ltd: London.

A.A. Glatthorn, R.L. Joyner, 2005, *Writing The Winning Thesis Or Dissertation: A Step-by-step Guide*, Sage Publications Inc (USA) - Corwin Press: Thousand Oak, CA.

D. Beer, 2003, *Writing and Speaking in the Technology Professions: A Practical Guide*, John Wiley & Sons Inc. London.

SUMMARY DESCRIPTION

This module will introduce students to fundamental problems, principles, approaches and tools for designing and managing research. The module will facilitate the development of skills for acquiring, combining and assessing evidence to support findings and hypotheses. It will enhance their understanding of legal, professional, ethical and societal concerns related to scientific research. The student will understand key processes involved in designing, managing and

reporting scientific research. The student will learn fundamental skills and techniques for critically assessing research outcomes.

MODULE TITLE:	Mobile and Wireless Networks	
MODULE CODE:	COM877J1 (CRN: 3002)	
DATE OF REVISION:	2008/9	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory for PG Dip in Computing (Communications)	
	Optional for P G Dip in Computing P G Dip in Computing (Web Technology) P G Dip in Computing (Artificial Intelligence) P G Dip in Computing (Health Informatics)	
SEMESTER:	1	
LOCATION:	Jordanstown	
E-LEARNING:	Web supplemented	
PREREQUISITE(S)	None	
CO-REQUISITE(S)	None	
MODULE CO-ORDINATOR(S):	Adamson, K	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY	Adamson, K	
HOURS:	Lectures	12 hrs
	Seminars	12 hrs
	Tutorials	12 hrs
	Practicals	0 hrs
	Independent study (including assessment)	114 hrs
TOTAL EFFORT HOURS:	150	
ACADEMIC SUBJECT:	COM	

RATIONALE

Most computers exist in a distributed environment requiring exchange of information with other computers. In addition to ubiquitous LANs and WANs, applications range from personal area networks to high performance GRIDs. GUIs and multi-media consume bandwidth and faster communications are demanded. This module advances underlying communication and networking theory by investigating the latest wireless networking architectures and protocols, using authoritative sources. There is also an increasing demand for mobile computing. This module introduces high performance broadband and wireless networking and discusses emerging technologies. The module also investigates the security implications of networks and studies practical multimedia applications on the Internet.

AIMS

- i) to introduce students to advanced network concepts such as high speed LANs;
- ii) to develop in students an appreciation of the advantages of integrating networked technologies;
- iii) to develop an understanding of the advantages of integrating different types of data for transmission across a network;
- iv) to develop in students an appreciation of the architecture and protocols for Internetworking;
- v) to give students an understanding of emerging network technologies;
- vi) to develop in students an appreciation the evolutionary nature of computer networks and discuss the latest technologies.

Vii)to develop a critical understanding of the communication parameters of networks and the need for compression of data together with the security issues involved with computer networks.

LEARNING OUTCOMES

A successful student will be able to show that he/she can:

KNOWLEDGE AND UNDERSTANDING

- K1 Demonstrate an advanced understanding of concepts, principles, theories and practices underlying the use of networks;
- K2 Critically appraise the current and emerging developments in wireless network technologies, architectures and protocols;
- K3 Provide specifications appropriate to computer networks and plan strategies for their implementation ;
- K4 Demonstrate the need for security procedures and protocols in networking;
- K5 Communicate effectively ideas, proposals, and designs to a range of audiences, using rational and reasoned arguments;

K6 Understand the professional, legal, moral and ethical issues involved in the exploitation of telecommunications technology;

INTELLECTUAL QUALITIES

- I1 Abstract and model computer network scenarios;
- I2 Critically appraise the influence of communication parameters on network and computer performance ;
- I3 Assess the implications, and consequences of applying a networked based solution to selected application domains;

PROFESSIONAL/PRACTICAL SKILLS

- P4 can effectively deploy computer based tools towards the construction and documentation of telecommunications applications;
- P5 can author technical reports regarding the telecommunications industry for a range of users with different technical capabilities;
- P6 can undertake a substantial piece of research dealing with modern
+ telecommunications breakthroughs and their business applications;

TRANSFERABLE SKILLS

- T1 Compose a suitably formatted report for technical readers; communicate effectively networking ideas, proposals and designs with their peers and the lecturer;
- T2 Demonstrate numerical competence in analyzing and manipulating network performance parameters;
- T3 Use appropriate Internet resources for research into networks;
- T5 Manage their own learning and can demonstrate self-direction and originality in
+ tackling and solving problems

CONTENT

Orthogonal Frequency Division Multiplexing

Frequency Hopping, Direct Sequence Spread Spectrum

RFCs and evidence

Personal Area Networks: Bluetooth architecture, IEEE 802.15 protocols

Bluetooth profile, 802.15 frames

Zigbee

Wireless LANS; 802.11a, 802.11b, 802.11g

Modulation methods

802.11 frames

Broadband Wireless Networks

Metropolitan Area Networks MAN, IEEE802.16

802.16 frames

Wireless Cellular Systems – 3G evolution

UMTS,

High Speed Downlink Packet Access (HPDA)

Mobile IP

Routing algorithms

Quality of Service Issues

Security Issues

WEP

Applications Wireless Application Development

Legal and ethical issues associated with modern telecommunications solutions

TEACHING AND LEARNING METHODS

The course will be taught by lectures, tutorials and seminars. The course will explore the developments in wireless networks. Due to the rapid technological advance of computer networks, theory will be augmented by the study of newsworthy network topics and research topics via journals and Internet sites.

Lectures will provide appropriate theory for wireless networks.

Seminars will address emerging topics and relate these to the theory.

Tutorials will address numerical underpinning, using worked examples to indicate the relationship between bandwidth, speed of communication, end user applications and choices of topology and infrastructure.

Students will be directed to appropriate research material and up-to-date articles from network sources.

Students will be expected to contribute to an active learning environment, by participating in discussion, presentation and adhering to deadlines for submission.

Opportunities to demonstrate the best business practices will be explored via invited seminars from telecommunications industrialists.

The module is web-supplemented.

READING LIST

Required

Halsall, F. 2005 "Computer Networking and the Internet", 5th Edition, Addison Wesley.

Recommended

Olifer N and Olifer V, 2006, "Computer Networks: Principles, Technologies and Protocols for Network Design", Wiley.

Panko, R.R. 2005 "Business Data Networks and Telecommunications", 5th Edition, Prentice-Hall.

Tanenbaum, A.S. 2002, "Computer Networks", 4th Edition, Prentice Hall.

Skelton, G.W, 2003, "Wireless application Development", Thompson Course Technology.

Comer, D.E., 2001, "Computer Networks and Internets with Internet Applications", 3rd Edition, Prentice Hall.

Halsall, F., 2001, "Multimedia Communications, Applications, Networks, Protocols and Standards", Addison Wesley.

Stallings W. 2000, "Data and Computer Communications", 6th Edition, Macmillan.
Networks Journals and publications, as advised during module

SUMMARY DESCRIPTION

The module explores high speed networks and mobile computing, with an emphasis on wireless networking, and the need for security.

MODULE TITLE:	Autonomic Computing and Communications Short Title: Autonomic Computing	
MODULE CODE:	COM834J2	
DATE OF REVISION:	2007/8	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory for PG Dip in Computing (Communications)	
	Optional for P G Dip in Computing P G Dip in Computing (Web Technology) P G Dip in Computing (Artificial Intelligence) P G Dip in Computing (Health Informatics)	
SEMESTER:	2	
LOCATION:	Jordanstown	
E-LEARNING:	Web-supplemented	
PREREQUISITE(S)	None	
CO-REQUISITE(S)	None	
MODULE CO-ORDINATOR(S):	Sterritt R	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY	Sterritt R	
HOURS:		
	Lectures	24 hrs
	Seminars	0 hrs
	Tutorials	6 hrs
	Practicals	6 hrs
	Independent study (including assessment)	114 hrs
TOTAL EFFORT HOURS:	150	
ACADEMIC SUBJECT:	COM	

RATIONALE

Computing and Communication Systems are ever-increasingly becoming more complex. This has dramatic implications for their evolution and manageability not least in terms of their total cost of ownership and organizational long-term strategy. For example, one estimate is that IBM are having to add 15,000 people a year to their Service business to manage systems. Most discussions of next generation computational and communications systems (be they from a pervasive, ubiquitous, grid, utility, invisible, or ambient computing/comms view) recognise the need for systems with infrastructures that manage themselves.

This module focuses on the development of self-managing systems, inspired by the human body's autonomic nervous system. The ANS is that part of the nervous system that manages body functions such as blood circulation, intestinal activity, and hormonal secretion and production, all without conscious effort. The desire of autonomic computing and communications is to bring a similar self-managing level of capability to systems and thus free up the human user for higher-level concerns.

AIMS

The aims of this module are to:

- Provide an awareness of systems issues: complexity and TCO;
- Develop expertise in autonomic/self-managing system concepts;
- Provide expertise in how autonomicity may be retrofitted into systems;
- Provide knowledge on autonomic applications and domains;
- Explore research issues in Autonomic Computing and Communication;
- Evaluate the concept of the knowledge plane
- Stimulate interest in emerging Autonomic research that affects next generation computation and communications paradigms.

LEARNING OUTCOMES

A successful student will be able to show that he/she can:

KNOWLEDGE AND UNDERSTANDING

- K1 Evaluate critically the complexity and total cost of ownership issues for computing and communications systems.
- K2 Evaluate critically the data and control planes of networks.
- K3 Understand the autonomic concepts, approaches, techniques and constructs.

INTELLECTUAL QUALITIES

- I1 Evaluate critically autonomic concepts, approaches, techniques and constructs.

- I2 Provide self-direction and originality in solving problems with conceptually retrofitting autonomy into systems.
- I3 Evaluate critically current research and provide demonstrable advanced scholarship via self-direction and originality in assessing applied autonomous research in such areas as personal autonomous computing, telecommunications reflex unified fault management, autonomous agents and swarms, autonomous cluster management.
- I4 Critically evaluate emerging research topics that will affect the future shape of computing and comms;

PROFESSIONAL/PRACTICAL SKILLS

- P1 Utilize current research and provide demonstrable advanced scholarship via self-direction and originality in assessing applied autonomous research in such areas as personal autonomous computing, telecommunications reflex unified fault management, autonomous agents and swarms, autonomous cluster management.
- P2 Utilize autonomous concepts, approaches, techniques and constructs.
- P3 Utilize evaluate emerging research topics that will affect the future shape of networks

TRANSFERABLE SKILLS

- T1 Provide self-direction and originality in solving problems with conceptually designing new and retrofitting autonomy into systems.

CONTENT

Complex System Fundamentals

Computing and Communications have become pervasive. They help entertain us —iPods and MP3 players. In GPS navigation systems, they help us get to our desired location. Present in our home appliances and cell phones. Effect our daily lives and future: defence systems, space exploration, and hospitals. Computer-based systems constantly infiltrate more and more daily activities, with public expectations of greater functionality, reliability, and continued operation. Despite this success and expansion into daily life, there have, of course, been a number of system-related disasters and near-disasters. Failures have resulted in giving cancer patients excessive (and lethal) doses of radiation, loss of aircraft and spacecraft, and disclosures of private financial information. We continue to push systems to the limits, in many cases using it where failure would be catastrophic, and where many organizations are spending as much as 33 to 50 percent of the total cost of ownership of their computing and communication systems to avoid failure.

- 1 Introduction; systems complexity and TCO problems
- 2 The communications data and management planes

Autonomic Computing

Many practitioners believe that self-managing systems can potentially ensure safer, more reliable, and cost-effective computer based systems. Creating systems that are self-directed, self-governing, and self-adapting has been the focus of development in autonomic computing and autonomic communications. Increasingly these systems are being referred to as *Selfware*.

- 1 Autonomic Properties, the autonomic element, control loops and environment
- 2 Autonomic Constructs
- 3 Autonomic Computing Research

Autonomic Communications

Current communication approaches recognise two architectural divisions, or planes: a data plane, over which content is forwarded, and a control or management plane, which is used to direct, measure, and repair the data plane. This part of the module examines each of these planes (the network component), and then explores each plane for fundamental weaknesses. In enumerating the weaknesses of each plane, the module investigates how networks can come under attack, and what can be done to remedy against attack.

- 1 The knowledge plane
- 2 Autonomic Communications research

TEACHING AND LEARNING METHODS

Lectures will present core material and example case studies of the application of particular techniques in example problem domains.

Tutorials and Practical Lab sessions will utilize practical exercises that will require students to apply autonomic concepts in a range of problem domains, to design self-management concept solutions and to justify the selection of particular technology for example problem domains.

Students will be required to research and read widely from suggested texts and from available on-line resources for emerging technology.

The module is web-supplemented.

ASSESSMENT

Coursework 1: (sample)

Diao et al considers autonomic optimisation of an Apache web server in their 2003 paper. Implement an Apache configuration for a chosen organization then critically evaluate the paper and comment on the future options for self-managing web servers and infrastructure. (Y. Diao, J. L. Hellerstein, S. Parekh, and J. P. Bigus, " Managing Web server performance with AutoTune agents" IBM Systems Journal, Vol 42, No 1, 2003, pp. 136-149, <http://www.research.ibm.com/journal/sj/421/diao.pdf>)

This assignment will measure the student's achievement of learning outcomes K1, K2, (K4, I3, P1, T2) & (I4, P3)

Coursework 2: (sample)

Consider an application, application area, system, system of systems or an information system (henceforth referred to as system). Conduct a literature review on the current state of the area of your chosen system, submitting a critical review, with detailed citations throughout. Highlighting current restrictions, design an autonomic solution for your system.

This assignment will measure the student's achievement of learning outcomes (I2, T1), (K3, I1, P2), (K4, I3, P1, T2) & (I4, P3)

Examination:

The examination is typically two hours long, closed book, and be composed of two sections that contribute equal marks. Section A will be composed of compulsory short questions. Section B will be composed of three longer questions of equal value of which students are to attempt two. The examination will measure the student's achievement of learning outcomes K1-K4, I1-I3 and P1- P2 for the module.

50% Coursework

50% Examination

READING LIST

Required

- Murch, R, 2004, *Autonomic Computing*, Prentice Hall PTR, pp 356.
- Truszkowski WF, Hallock L., Rouff CA, Kerlin J, Rash JL, Hinchey MG, and Sterritt R, 2008, *Autonomous and Autonomic Systems with Applications to NASA Intelligent Spacecraft Operations and Exploration Systems*, NASA Monographs in Systems and Software Engineering. Springer-Verlag, London, UK.

Recommended (Bibliography Source for Module Material)

- Ganek A, and Corbi T, *The Dawning of the autonomic computing era*, IBM Systems Journal, 42(1):5-18, 2003.
- Kephart J and Chess D, 2003, *The Vision of Autonomic Computing*. IEEE Computer 36(1): 41-50 (2003).
- Hinchey M.G., and Sterritt R., *Self-Managing Software*, Computer, Vol. 39, No. 2, IEEE Computer Society, ISSN 0018-9162, Pages 107-109, Feb 2006
- Clark D, Partridge C, Ramming J, and Wroclawski J, *A Knowledge Plane for the Internet*, In Proc. of SIGCOMM, 2003.
- Sterritt R, Parashar M, Tianfield H, and Unland R, *A Concise Introduction to Autonomic Computing*, Journal of Advanced Engineering Informatics, Engineering Applications of Artificial Intelligence, Special Issue on Autonomic Computing and Automation, Elsevier Publishers, 2005.
- Want R, Peering T, and Tennenhouse D, *Comparing autonomic and proactive computing*, IBM Systems Journal, 42(1) pp 129-135, 2003.
- Kaiser G, Parekh J, Gross P and Valetto G, *Kinesthetics eXtreme: An External Infrastructure for Monitoring Distributed Legacy Systems*, Proceedings of Autonomic Computing Workshop, 2003, 25 June 2003 pp 22-30
- Diao Y, Hellerstein JL, Parekh S, and Bigus J.P, " *Managing Web server performance with AutoTune agents*" IBM Systems Journal, Vol 42, No 1, pp. 136-149, 2003
- Lawson, H. W. 2002. *Rebirth of the computer industry*. Commun. ACM 45, 6 (Jun. 2002), 25-29.
- Sterritt R, (Dec 2002) "*Towards Autonomic Computing: Effective Event Management*", Proc 27th Ann IEEE/NASA Software Engineering Workshop (SEW), Maryland, USA, December 3-5, IEEE Computer Society, Pages 40-47
- Sterritt R, Bustard DW, (Apr 2003) "*Autonomic Computing-a Means of Achieving Dependability?*", Proceedings of IEEE International Conference on the Engineering of Computer Based Systems (ECBS'03), Huntsville, Alabama, USA, April 7-11, IEEE CS Press, Pages 247-251
- Sterritt R, (Oct 2004) "*Autonomic Networks: Engineering the Self-Healing Property*", Engineering Applications of Artificial Intelligence, Vol. 17, No. 7, Elsevier, ISSN 0952-1976, Pages 727-739
- Sterritt R, Hinchey MG, (Apr 2005) "*Why Computer-Based Systems Should be Autonomic*", Proc of 12th Ann IEEE Int Conf Engineering of Computer

Based Systems (ECBS 2005), Greenbelt, MD, USA, 3-8 April, 2005, Pages 406-414

- Sterritt R, (2005) *"Autonomic Computing"*, Innovations in Systems and Software Engineering, Vol. 1, No. 1, Springer, ISSN 1614-5046, Pages 79-88
- Hinchey MG, Rash JL, Truszkowski WF, Rouff CA, Sterritt R, (2005) *"You Can't Get There From Here! Problems And Some Potential Solutions In Developing New Classes Of Complex Systems"*, Journal of Integrated Design and Process Science, Vol. 9, No. 1, IOS Press, ISSN 1092-0617, Pages 1-16
- Sterritt R, Dobson S, Smirnov M, (Jul 2005) *"Proceedings of the 2005 IJCAI Workshop on AI and Autonomic Communications "*, Pages 1-47
- Sterritt R, Hinchey MH, (Aug 2005) *"Autonomicity – An Antidote for Complexity?"*, Proceedings of IEEE CSB 2005 Workshops, Stanford, CA, August, 8-12, Pages 283-291

SUMMARY DESCRIPTION

The module provides a fresh perspective of computing and communications, explores the problems affecting systems, and assesses new research that proposes Autonomic and self-managing approaches to address some of today's problems while providing the way forward to facilitate next generation computation and communications.

MODULE TITLE:	Advanced Web Technologies	
MODULE CODE:	COM835J1	
DATE OF INTRODUCTION:	2007/8	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory for PG Dip in Computing (Web Technology)	
	Optional for P G Dip in Computing P G Dip in Computing (Communications) P G Dip in Computing (Artificial Intelligence) P G Dip in Computing (Health Informatics)	
SEMESTER:	1	
LOCATION:	JN	
E-LEARNING:	Web supplemented	
PREREQUISITE(S):	None	
CO-REQUISITE(S):	None	
MODULE CO-ORDINATOR(S):	Chen; L	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY:	Chen; L	
HOURS:	Lectures	24hrs
	Seminars	2hrs
	Tutorials	4hrs
	Practicals	6hrs
	Independent study, mainly background reading (including assessment)	114hrs
TOTAL EFFORT HOURS:	150 hours	
ACADEMIC SUBJECT:	COM	
MODULAR SUBJECT:	Not applicable	

RATIONALE

The Web has changed the way people learn, communicate, do business and earn a living. This has been enabled and supported by the constant innovation of Web technologies. The recent emergence and uptake of Web 2.0 and Web 3.0 has shown that a new wave of advanced Web technologies, though at an early stage, is ready for adoption and novel Web applications. This module introduces students to the state of the art of advanced Web technologies, their implementation and applications.

AIMS

To introduce the concepts and rationale of advanced Web technologies such as Web 2.0, Semantic Web, ontologies, Web Services, etc.

To provide students with technologies, tools and practical experience to use advanced Web technologies for application development and deployment.

To introduce and showcase students various applications of advanced Web Technologies, such as Semantic Web based large scale knowledge management, collaborative tagging, Service oriented computing, etc.

LEARNING OUTCOMES

A successful student will be able to show that he/she:

KNOWLEDGE AND UNDERSTANDING

- K1 Has a clear overview of the state of the art and trends of various advanced Web technologies;
- K2 Understands in-depth the core concepts and rationale of each individual advanced Web technology;
- K3 Understands the advantages and application area of each individual advanced Web technology;
- K4 Understands the various software technologies and tools for implementing each individual advanced Web technology;

INTELLECTUAL QUALITIES

- I1 Is able to apply advanced Web technologies to real world problems;
- I2 Can develop problem-solving strategies and methodologies for problems using advanced Web technologies;
- I3 Can draw on current research results, prototypes and best practices in the use of advanced Web technologies;

PROFESSIONAL/PRACTICAL SKILLS

- P1 Can critically reflect and evaluate the state of the art for an individual advanced Web technology;
- P2 Can conceive, specify and design systematic solutions to problems using advanced Web technologies;
- P3 Is able to implement an application system using a variety of technologies and tools;

P4 Is able to evaluate, report and refine systems that are based on advanced Web technologies;

TRANSFERABLE SKILLS

- T1 Work effectively and supportively in both independent and collaborative modes;
- T2 Can explain and communicate advanced Web technologies and respond to the diverse needs of applications;
- T3 Is able to write technical reports and discuss issues related to advanced Web technologies.

CONTENT

The following topics will be covered.

- Introduction to advanced Web technologies
Overview of the state of the art and trends of Web technologies
- Ontology engineering
Ontology modeling, representation, query and reasoning
- The Semantic Web
The concept, semantic content generation, storage, reuse
- Web services - Service oriented architecture (SOA)
Messaging (SOAP), Service Interfaces (WSDL) and Registration and Discovery (UDDI)
- Current applications of advanced web technologies
Semantic Web services, large-scale knowledge management, etc.

TEACHING AND LEARNING METHODS

Lectures will be used to introduce new concepts, models and knowledge.

Seminars will give students the opportunity to explore issues in more depth.

Tutorials will help students to understand and master new materials by doing exercises or answering questions using paper and pencil.

Practical exercises will consolidate students' understanding of new material and further help students master various technologies, tools and skills for effective use of advanced Web technologies.

Directed reading will provide students with relevant material online, from textbooks or notes closely related to specific topics so that important concepts or technologies can be mastered.

Students will be expected to extend their knowledge by self-study through reading extensively and using professional programming material online.

The module is web supplemented. Material is available on a web-site.

ASSESSMENT

Coursework 1

Percentage contribution: 35% of coursework

Students are asked to survey the literature in a particular field of advanced Web technologies, for example the latest trend of technologies and applications in Semantic Web.

This assignment will measure the student's achievement of module learning outcomes :K1, K2, K3, K4, P1, P4, T1, T3.

Coursework 2

Percentage contribution: 35% of coursework

Students are asked to conceive, design and partially implement a prototype system that makes use of knowledge, technologies and tools in the reviewed field carried out in part one. For example, they might be asked to create a personal knowledge management system using personal ontologies or to develop a service-oriented e-commerce system, etc.

This assignment will measure the student's achievement of module learning outcomes :K3, I1, I2, I3, P2, P3, P4, T1, T3

Coursework 3

Percentage contribution: 30% of coursework

This coursework will be a class test in week 10 of the module. The test will last for 50 minutes. Students should expect to spend approximately 18 hours revising for the test.

This assignment will measure the student's achievement of module learning outcomes :K1, K2, K3, K4, I2, P1, P2, T2, T3

100% Coursework

0% Examination

2. READING LIST

Required

Grigoris Antoniou and Frank van Harmelen, 2008, A Semantic Web Primer, 2nd edition, The MIT Press, ISBN-13:978-0-262-01242-3

Electronic source:

<http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=11477>

Ascuncion Gomez Perez, Mariano Fernandez-Lopez and Oscar Corcho-Garcia, 2004, Ontological Engineering, SPRINGER, ISBN:1852335513

Electronic source:

<http://www.amazon.com/Ontological-Engineering-Management-e-Commerce-Information/dp/1852335513>

John Davies, Rudi Studer and Paul Warren, 2006, Semantic Web Technologies: Trends and Research in Ontology-based Systems, Wiley, ISBN-13: 978-0470025963

Electronic source:

http://www.amazon.com/Semantic-Web-Technologies-Research-Ontology-based/dp/0470025964/ref=pd_sim_b_title_4

Gustavo Alonso, Fabio Casati, Harumi Kuno and Vijay Machiraju, 2004, Web Services: Concepts, Architectures and Applications, Springer Verlag, ISBN 3-540-44008-9

Electronic source:

<http://www.amazon.com/Web-Services-Gustavo-Alonso/dp/3540440089>

Recommended

Community websites such as W3c portal, Semantic Web portal and Web service portal, Jena API portal

Electronic source: <http://www.w3.org/>

SUMMARY DESCRIPTION

The Web has changed the way people learn, communicate, do business and earn a living. This has been enabled and supported by the constant innovation of Web technologies. The recent emergence and uptake of Web 2.0 and Web 3.0 has shown that a new wave of advanced Web technologies, though at early stage, is ready for adoption and novel Web applications. This module introduces students to the state of the art of advanced Web technologies, their implementation and applications.

MODULE TITLE	E-Business Innovation	
MODULE CODE	COM917J2 (CRN: 3029)	
DATE OF REVISION	2008/09	
MODULE LEVEL	7	
CREDIT POINTS	15	
SEMESTER	2	
	Compulsory for PG Dip in Computing (Web Technology)	
MODULE STATUS	Optional for P G Dip in Computing P G Dip in Computing (Communications) P G Dip in Computing (Artificial Intelligence) P G Dip in Computing (Health Informatics)	
LOCATION	Jordanstown	
E LEARNING	Web supplemented	
PREREQUISITE(S)	None	
COREQUISITE(S)	None	
MODULE COORDINATOR	Prof Mulvenna	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY	Prof Mulvenna	
CONTACT HOURS	Lectures	24
	Tutorials	12
	Independent Study	114
TOTAL EFFORT HOURS	150	
ACADEMIC SUBJECT	COM	
Rationale	<p>Many organisations have adopted e-business in response to customer expectations, to remain competitive in their business market, and to achieve efficiencies over current business practices. E-business is a major application area of ICT, and is a focus for innovative business practice. This module provides students with an introduction to the main areas of e-business, and the primary sources of entrepreneurial actions and innovations from a perspective of technology supporting new business processes.</p>	
Aims	<p>The aims of this module are to:</p> <ul style="list-style-type: none"> ▪ Give students an understanding of e-business and its practical application in a range of business settings. ▪ Present the underlying business processes and supporting technologies required for e-business and the operational considerations in their effective use. 	

- Explore the frameworks for e-business, technologies, business models and innovative practice in e-business processes.

Learning Outcomes

Knowledge and understanding

A successful student will be able to show that they can:

- K1 Understand the fundamental concepts, principles and theories underlying e-business systems.
- K2 Recognise and analyse the criteria and specifications associated with specific problems in e-business systems and plan strategies for their implementation.
- K3 Employ practices for the specification, design, implementation and critical evaluation of e-business applications

Intellectual skills and other attributes

A successful student will be able to show that they can:

- I1 Acquire and evaluate e-business scenarios, materials and practices.
- I2 Evaluate e-business practice against published best practice models and methodologies. Identify innovation in e-business practice.
- I3 Assess the implications, and consequences of applying an e-business solution to replace existing business process and practice.
- I4 Devise route maps and likely scenarios for future innovation in e-business theory and practice.

Practical Skills

A successful student will be able to show that they can:

- P1 Select and use e-business concepts and models underlying e-business and e-commerce practice through class group work or other assessment/class work.
- P2 Be capable of scanning, synthesising and organising information, and extracting meaning from information.

P3 To undertake a substantial piece of work in e-business innovation that covers an investigation into a specific case study area and includes an original component of work with analysis, synthesis and comment.

Transferable skills

A successful student will be able to show that they can:

- T1 Learn in both familiar and unfamiliar situations making effective use of information-retrieval skills and of learning resources.
- T2 Use general Information Technology facilities to deal with e-business concepts and issues.

Content

Introduction to e-business

Define the meaning and scope of e-business and e-commerce and their different elements
Summarize the main reasons for adoption of e-commerce and e-business and barriers that may restrict adoption
Use resources to define the extent of adoption of the Internet as a communications medium for consumers and businesses
Outline the business challenges of introducing e-business and e-commerce to an organization.

E-commerce Fundamentals

Evaluate changes in business relationships between organizations and their customers enabled by e-commerce
Identify the main business and marketplace models for electronic communications and trading
Describe different revenue models and transaction mechanisms available through online services.

E-business Infrastructure

Outline the hardware and software technologies used to build an e-business infrastructure within an organisation and with its partners
Outline the hardware and software requirements necessary to enable employee access to the Internet and hosting of e-commerce services.

E-environment

Identify the different elements of an organization macro-environment that impact on an organization e-business and e-marketing strategy
Assess the impact of legal, privacy and ethical constraints or opportunities on a company
Assess the role of macro-economic factors such as governmental e-business policies, economics, taxation and legal constraints.

E-business strategy

Follow an appropriate strategy process model for e-business;
Apply tools to generate and select e-business strategies;
Outline alternative strategic approaches to achieve e-business.

E-marketing

Assess the need for separate e-business and e-marketing strategies
Create an outline e-marketing plan intended to implement the e-marketing strategy
Distinguish between marketing communication characteristics of traditional and new media.

Customer relationship management

Outline different methods of acquiring customers via electronic media
Evaluate different buyer behaviour amongst online customers
Describe techniques for retaining customers and cross-and up-selling using new media.

Supply Chain Management

Identify the main elements of supply chain management and their

relationship to the value chain and value networks

Assess the potential of information systems to support supply chain management and the value chain.

E-procurement

Identify the benefits and risks of e-procurement

Analyze procurement methods to evaluate cost savings

Assess different options for integration of organizations' information systems with e-procurement suppliers.

E-business Innovation

Innovation models and practices. Innovation in the Digital Age. Open Innovation. Challenges in change management – the role of innovation.

Case Studies

Appropriate case studies (for example, DDOS; Page Rank; Collaborative Filtering); Applying concepts and theories of e-business to real world examples. Examples of entrepreneurial E-business innovations will be examined.

Learning and Teaching Methods

Lectures will be used to present core concepts and to introduce practical examples of e-business.

Focused exercises will allow students to examine and evaluate practical examples of e-business and to identify web resources relating to underlying e-business technologies.

Coursework will be assessed as blog submissions together with performance at tutorials.

The module is web supplemented.

Assessment

Assessment is 100% coursework. There are a number of assessments for this module. The first set of five assessments will require the completion of short posting to blogs followed by group discussions in tutorials. This will constitute 70% of your coursework. The second assessment is termed the main individual assessment and will constitute 30% of your coursework. The focus of the assignments may change each year.

The assignments are designed to encourage students to reflect critically on an actual e-business market or research area, and draw on relevant theory and practice in analysing the e-business marketplace, customers, products and opportunities.

In each assessment, the student is asked to:

- Critically examine the technologies put forward;
- Examine the social, legal and ethical issues arising from the use of the technology;
- Explain the business model(s) used that are underpinned by this technology;
- Examine and describe the risks or negative issues in the use of this technology;
- Examine and describe the opportunities or beneficial issues in the use of this technology; and
- Put forward suggestions about what the future hold for this area.

The students will work to analyse the selected market or research area. Students will be encouraged to develop group-working skills and asked to present tutorials on their findings. Individual marks for the group work will be allocated based on the assessment by the academic tutor of their blog material together with the preparation and presentation skills shown by the students. The assignments will measure the students' achievement of learning outcomes K1, K2, K3, I1, I2, I3, I4, P1, P2, P3, T1, T2.

For each assignment, the students will follow a Search-Synthesise-Display-Discuss (SD2) methodology. Students will use web search engines and Internet resources to search for information on the task given in the assignment. The students will work together to synthesise the material found (plagiarism from 'net sources will result in group failure), before displaying the material in a group blog. Finally, after completing the assignment online, the student will discuss the assignment material in a tutorial.

Distribution of marks between coursework and examination

100	% Coursework	0	% Examination
-----	--------------	---	---------------

Reading List

Recommended

Chaffey, D. (2006), E-Business and E-Commerce Management, Financial Times/ Prentice Hall, (658.05/CHA) ISBN 1405847069

Chen, S., (2005), Strategic Management of E-Business, 2nd Edition, John

Wiley and Sons Ltd, ISBN: 0471496332

Chesbrough, H. (2006) *Open Business Models: How companies thrive in the new innovation landscape*. Harvard Business School Press: Boston, MA.

Turban, E., King, D., Viehland, D. and Lee, J. (2006), *Electronic Commerce: A managerial Perspective*, Prentice Hall

Journal Articles

Fowles, S. and Clark, W. (2005) Innovation networks: good ideas from everywhere in the world. Strategy and Leadership. 33 4 pp 46.

Kirschbaum, R. (2005) Open Innovation in Practice. Research-Technology Management. 48 4 pp 24-28.

Journals

International Journal of Electronic Commerce
Journal of Internet Research
International Journal of Electronic Commerce and Business Media
International Journal of Electronic Markets
Journal of electronic commerce research
Electronic Commerce Research and Applications
Electronic Commerce Research
MIS Quarterly
Harvard Business Review
Sloan Management Review
Business Week
The Economist

Summary Description

Many organisations have adopted e-business tools, process and methods in response to customer expectations, to remain competitive in their business market, and to achieve efficiencies over current business practices. E-Business is a major application area of ICT, driving innovation in both technology usage and in defining new business processes and techniques. This module gives students an introduction to the types and scope of e-commerce, e-business and the role of the underlying technologies necessary for its effective implementation. Assessment is by 100% coursework.

MODULE TITLE:	Intelligent Agents	
MODULE CODE:	COM836J1	
DATE OF INTRODUCTION:	2007/08	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory for P G Dip in Computing (Artificial Intelligence)	
	Optional for P G Dip in Computing P G Dip in Computing (Communications) PG Dip in Computing (Web Technology) P G Dip in Computing (Health Informatics)	
SEMESTER:	1	
LOCATION:	Jordanstown.	
E-LEARNING:	Web supplemented	
PREREQUISITE(S):	Basic knowledge of programming languages like C, C+ +, Java or Prolog. Desirable: a previous module on Artificial Intelligence.	
CO-REQUISITE(S):	None	
MODULE CO-ORDINATOR(S):	Augusto, JC.	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY:	Augusto, JC.	
HOURS:		
	Lectures	18 hrs
	Seminars	0 hrs
	Tutorials	0 hrs
	Practicals	18 hrs
	Independent study (including assessment)	114 hrs
TOTAL EFFORT HOURS:	150 hours	
ACADEMIC SUBJECT:	COM	

RATIONALE

One of the latest paradigms in Computer Science considers problem solving as an activity that can be performed by programs called agents which are characterised by exhibiting autonomy and interaction at a level that resembles human social interaction.

This module will be focused on the understanding of basic concepts underlying agents-based technology and on the methods and tools for the creation of agents capable of performing tasks in the real world.

AIMS

This module will introduce the students to methods and tools in the area of intelligent agents. Students will learn about the motivations for these methods and tools, will explore at least one software development framework which facilitates the construction and deployment of agents to solve problems in the real-world.

LEARNING OUTCOMES

A successful student will be able to show that he/she can:

KNOWLEDGE AND UNDERSTANDING

- K1 Articulate the motivations behind the use of Intelligent Agents
- K2 Articulate the main concepts making possible the use of Intelligent Agents and associated tools
- K3 Identify problems where Intelligent Agents can/should be used

INTELLECTUAL QUALITIES

- I1 Analyse current existing platforms for building Intelligent Agents
- I2 Assess pros and cons of different methodologies and tools related to Intelligent Agents

PROFESSIONAL/PRACTICAL SKILLS

- P1 Apply methods to design Intelligent Agents
- P2 Deploy Intelligent Agents as part of a real computational system

TRANSFERABLE SKILLS

- T1 Recognize how the methods and tools developed for Intelligent Agents can be used in a range of different areas of Computer Science (e.g., e-commerce)
- T2 Apply the criteria for selecting different Intelligent Agents according to the characteristics of a problem

CONTENT

Motivations for the use of Agents in computing. Basic concepts. Different environments and types of Agents.

Deliberative Architectures. Deductive Reasoning Agents. Logics for multi-agent systems. Epistemic logics. Formal methods in specification, implementation and verification of agents. Agents as theorem provers. Agents acting in dynamic worlds. Planning. BDI Architecture.

Reactive and Hybrid Architectures. Subsumption architecture. Situated automata. Advantages and limitations of purely reactive architectures. Hybrid deliberative-reactive architectures.

Multi-agent Interactions. Utilities and preferences. Nash equilibria. Reaching agreements. Negotiations. Argumentation.

Communication. Speech acts and agent communication languages.

Collaborative agents. Task sharing and result sharing. The Contract Net. Handling Inconsistency. Cooperative Distributed Problem Solving. Coordination. Synchronization.

Development methodologies. When an agent-based solution is appropriate. Pitfalls of agent development. Mobile Agents.

Applications. Business Process management. Distributed sensing. Information retrieval. Electronic commerce. Human-computer interfaces. Virtual environments. Social simulation. Others.

TEACHING AND LEARNING METHODS

Lectures will introduce the main technical components of the module, with illustrative examples and demos to present the fundamental concepts behind this technology.

Practical exercises will enable the students to gradually understand new concepts and build operative agents.

Students will be directed to read a number of selected publications, either from conference proceedings or from journals reporting on real-life applications of the methods and tools considered.

Students will be expected to use agent-based tools to design and build agent-based systems, to deploy them and to analyse their behaviour.

The module is web supplemented to provide students a more flexible interaction and access to the learning resources.

ASSESSMENT

Coursework 1:

Students will be asked to define a problem suitable for treatment with intelligent agents and to go through the design stage. This coursework will be worth 20% of the marks for the module. This assignment will measure the student's achievement of module learning outcomes I1-2, P1-2 and T1-2.

Coursework 2:

Students will be asked to use implement and deploy the system defined for the previous coursework. This coursework will be worth 30% of the marks for the module. This assignment will measure the student's achievement of module learning outcomes I1-2, P1-2 and T1-2.

Examination:

The written examination is 2 hours in duration. The paper consists of 5 questions focusing on learning outcomes K1-K2-K3. Students will be required to answer 3 questions in total.

50 % Coursework

50 % Examination

READING LIST

Required

Michael Wooldridge, 2002, *An Introduction to Multiagent Systems*, Chichester, England, John Wiley & Sons.

Rafael H. Bordini, Jomi Fred Hübner, Michael Wooldridge, 2007, *Programming Multi-agent Systems in AgentSpeak Using Jason*, Chichester, England, Wiley and Sons.

Recommended

S. Russell and Peter Norvig, 2003, *Artificial Intelligence: A Modern Approach (Second Edition)*, Prentice Hall.

Maria Fasli, 2007, *Agent Technology For E-Commerce*, Chichester, Wiley and Sons.

Joseph P Bigus and Jennifer Bigus, 2001, *Constructing Intelligent Agents Using Java*, Chichester, John Wiley and Sons.

Other articles and books related to intelligent agents will be suggested throughout the semester.

SUMMARY DESCRIPTION

This module focuses on methodologies and tools that can be used to design, implement and deploy intelligent agents. These methods and tools are being applied in the real world to solve problems and it is expected the student will exercise this possibility through adequate applications. These exercises will be used to better understand the fundamental concepts of the area, the process of development and deployment and also the scope of application of this technology.

MODULE TITLE:	Applied Computational Intelligence	
MODULE CODE:	COM837J2	
DATE OF INTRODUCTION:	2007/8	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory for P G Dip in Computing (Artificial Intelligence)	
	Optional for P G Dip in Computing P G Dip in Computing (Communications) PG Dip in Computing (Web Technology) P G Dip in Computing (Health Informatics)	
SEMESTER:	2	
LOCATION:	Jordanstown.	
E-LEARNING:	Web supplemented	
PREREQUISITE(S):	None	
CO-REQUISITE(S):	None	
MODULE CO-ORDINATOR(S):	Liu, J	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY:	Liu, J	
HOURS:	Lectures	22 hrs
	Seminars	4 hrs
	Tutorials	5 hrs
	Practicals	5 hrs
	Independent study (including assessment)	114 hrs
TOTAL EFFORT HOURS:	150	
ACADEMIC SUBJECT:	COM	
MODULAR SUBJECT:	n/a	

RATIONALE

Today, based on the advances in IT and digital data storage, in many industrial, economic, medical or other application areas, increasing amounts of signals, measurements, images and other types of data become available, implicitly describing underlying processes or structures. Machines that interact with their environment must learn about and optimise their behaviour in that environment based on the available data. Data Mining is concerned with the automated extraction of knowledge, or hidden patterns from very large data bases. Using state-of-the-art Artificial Intelligence methods, this technology builds computer systems capable of learning from past experience, allowing them to adapt to new tasks, predict future developments, and provide intelligent decision support. Applications are found in a wide range of fields including business, marketing, medicine, bioinformatics, robotics, computer vision and scientific discovery.

AIMS

This module aims to provide a grounding in the theoretical and practical aspects of data mining and machine learning, including the underlying principles, the techniques used and the applications of machine learning for data mining. The core of the module comprises a range of current machine learning techniques such as how the computational intelligence techniques (i.e. neural networks, evolutionary algorithms, swarm algorithms and fuzzy systems) can be used for knowledge extraction. In addition, traditional machine learning techniques such as decision trees, rule induction, clustering will be covered.

LEARNING OUTCOMES

A successful student will be able to show that he/she:

KNOWLEDGE AND UNDERSTANDING

- K1 Can demonstrate an understanding of the major machine learning and data mining techniques used in artificial intelligence;
- K2 Understands the context in which machine learning and data mining sits in relation to computer science and cognitive science;
- K3 Is familiar with the main trends in data mining research;
- K4 Understands the various machine learning technologies used for data mining;

INTELLECTUAL QUALITIES

- I1 Is able to describe and model real-world problems involving data mining;
- I2 Can recognize when knowledge discovery might be used and why it is important;
- I3 Can evaluate and apply current research and best practice in data mining with computational intelligence;
- I4 Can apply the theory of machine learning to various data mining problems

PROFESSIONAL/PRACTICAL SKILLS

- P1 Can critically evaluate the state of the art in data mining with computational intelligence;
- P2 Can demonstrate judgement in selecting the appropriate technique for a particular problem based on the characteristics of that technique;
- P3 Is able to implement a data mining technique using a variety of application packages;
- P4 Is able to read and digest research papers from conferences and journals;
- P5 Is able to relate theoretical knowledge to practical concerns;

TRANSFERABLE SKILLS

- T1 Is able to assess complex problems using the relevant professional sources;
- T2 Can design one or more solutions to a complex problem;
- T3 Can write a written report evaluating the state of the art of machine learning.

CONTENT (Indicative List of Topics)

Historical view of AI

Issues arising, current state of the art. Tasks for which an AI approach is suitable. Computational intelligence

Introduction to machine learning and data mining

What are machine learning and data mining? Examples of tasks suitable for learning; learning strategies; computational paradigms; knowledge discovery from databases (KDD); pre-processing of data to prepare data for the algorithms used; fields of application: science, business, the Web and e-business.

Classification methods

e.g. K-NNs, Decision Trees, Bayesian learning, and overview of other algorithms, which may include 'guest' lectures from medical informatics group.

Neural computing

Feedforward networks and hidden units; learning as search for suitable weights; network configuration for a problem; Backpropagation algorithm; training regimes; overfitting. This may include 'guest' lectures from the Intelligent System Centre at Magee.

Unsupervised learning methods

e.g. clustering: concept formation through unsupervised learning: K means, Kohonen net, SOM. Learning rules for identified clusters.

Evolutionary algorithms

e.g., basic theory, mechanisms and techniques of evolutionary computing (covering genetic algorithms, genetic programming and other evolutionary computing techniques).

Overview of other nature-inspired methods as appropriate

e.g. Ant Colony Optimisation and swarm algorithms.

Learning rules from examples

Association rule discovery. k-itemsets. Strength of rule: confidence and support Computational complexity: the Apriori algorithm. Market basket analysis.

Fuzzy Logic. Fuzzy variables, fuzzy IF-THEN rule, learning fuzzy rule from examples.

Evaluation of machine learning procedures

Theoretical limitations of machine learning, comparing learning algorithms

TEACHING AND LEARNING METHODS

Lectures will be used to convey theory and practice.

Seminars will give students the opportunity to explore issues in more depth.

Tutorials will provide problem-solving opportunities.

Practical exercises will provide experience in using some data mining packages, Weka/Clementine.

Students will be directed to read various papers and the textbook.

The module is web supplemented. Material is available on a web-site.

ASSESSMENT

Coursework 1

Percentage contribution: 40% of coursework

Students will be asked to survey the literature in an application of data mining to a particular field, for example that of benchmarking classification problem.

This assignment will measure the student's achievement of module learning outcomes : K1, K4, I1, P1, P2, T1.

Coursework 2

Percentage contribution: 60% of coursework

Data Mining mini-project using Clementine/ Weka; for example students may be asked to solve a classification problem using the data mining technique compared with a benchmark for this classification problem.

This assignment will measure the student's achievement of module learning outcomes : K4, I2, I4, P2, P3, P4, P5, T2, T3.

Examination

Percentage contribution: 50%

Students will be asked to answer three questions out of five in a two-hour examination.

The examination will be closed-book.

Learning outcome K1, K2, K3, K4 and I1, I2, I3, and I4 will be assessed.

Mark Distribution	
50% Coursework	50% Examination

READING LIST

There is no single text book that covers all the topics, the following books cover a portion of the course

Required

Engelbrecht, A.P., December 2007, *Computational Intelligence: An Introduction* (2nd Ed.), Chichester: John Wiley, ISBN: 978-0-470-03561-0

Recommended

Mitchell, T., 1997, *Machine Learning*. McGraw-Hill. ISBN: 0071154671.

Witten, I. and Frank, E., 2005, *Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations* (2nd Ed.), Morgan Kaufman. ISBN: 0120884070.

Russell, S. and Norvig, P., 2002, *Artificial Intelligence: A Modern Approach* (2nd ed), Prentice Hall.

Tan, P-N., Steinbach, M. and Kumar, V., 2006, *Introduction to Data Mining*, Addison Wesley.

Alpaydin, E., 2004, *Introduction to Machine Learning*, MIT Press.

Han, J. and Kamber, M., 2006, *Data Mining: Concepts and Techniques*, Morgan Kaufmann

Web references, journals and other sources

Web References

Russell, C. E., and Shi, Y.H., 2007, Computational Intelligence: Concepts to implementations (<http://www.computelligence.org/issue/CICI/CICI.html>), Elsevier/Morgan Kaufmann Publishers.

Nilsson, N.J., 2005, Introduction to Machine Learning (online book) <http://ai.stanford.edu/people/nilsson/mlbook.html>

Journals

Machine Learning, Springer Science+Business Media

IEEE Computational Intelligence Society (former Neural Networks Society)
ieee-nns.org

International Journal of Computational Intelligence and Organizations (IJCIO)

Computational Intelligence: An International Journal, Blackwell Publishing

ACM Journal of Machine Learning Research, ACM

IEEE Transactions on Pattern Analysis and Machine Intelligence

Conferences

A reading list of conference proceedings will be distributed for this course

SUMMARY DESCRIPTION

Machines that interact with their environment must learn about and optimise their behaviour in that environment based on the increasing amounts of data being captured, stored and made available electronically. Data Mining is concerned with the automated extraction of knowledge, or hidden patterns from very large data bases. Using state-of-the-art Artificial Intelligence methods, this technology builds computer systems capable of learning from past experience, allowing them to adapt to new tasks, predict future developments, and provide intelligent decision support. The aim of this module is to provide students with a comprehensive foundation and practical skills in data mining with computational intelligence including the underlying

principles, the techniques used and the applications. The module will prepare students for entry into PhD programmes or for employment in commercial environments and/or scientific/engineering research.

MODULE TITLE:	Health Informatics	
MODULE CODE:	COM838J1	
DATE OF INTRODUCTION:	2007/08	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory for P G Dip in Computing (Health Informatics)	
	Optional for P G Dip in Computing P G Dip in Computing (Communications) PG Dip in Computing (Web Technology) P G Dip in Computing (Artificial Intelligence)	
SEMESTER:	1	
LOCATION:	Jordanstown	
E-LEARNING:	Web Dependent	
PREREQUISITE(S):	None	
CO-REQUISITE(S):	None	
MODULE CO-ORDINATOR(S):	Finlay, DD and Nugent, CD	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY:	Finlay, DD and Nugent, CD	
HOURS:	Lectures	10 hrs
	Seminars	5 hrs
	Tutorials	10 hrs
	Practicals	10 hrs
	Independent study (including assessment)	115 hrs
TOTAL EFFORT HOURS:	150	
ACADEMIC SUBJECT:	COM	

RATIONALE

This module is designed to introduce and provide a fundamental understanding of the use of technology in healthcare. Emphasis is placed upon the use of technology to develop basic solutions for healthcare delivery and management. This shall be realised through understanding how technology is used in domains commonly referred to as medical informatics, biomedical engineering, ehealth, telecare and telemedicine. The module shall provide a framework to facilitate the design and development of robust solutions to meet current healthcare needs.

AIMS

- To give the student the opportunity to understand how technology can be applied in healthcare applications.
- To understand the need for technical solutions in healthcare applications.
- To investigate how robust solutions can be developed using existing technologies.
- To demonstrate examples of how healthcare delivery has been streamlined using technology.
- To give students an opportunity to understand common medical devices.
- To develop in all students the ability to work independently and collaboratively with fellow students.

LEARNING OUTCOMES

A successful student will be able to show that he/she can:

KNOWLEDGE AND UNDERSTANDING

- K1 Demonstrate a sound understanding of the fundamental concepts, principles, theories and practices underlying the use of technology for healthcare applications.
- K2 Understand the limitations of technology in healthcare applications.

INTELLECTUAL QUALITIES

- I1 Identify and justify health informatics solutions to address the requirements of a specific problem.
- I2 Critically evaluate, from a user needs perspective, current approaches to healthcare delivery.
- I3 Structure ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.
- I4 Apply computing science fundamentals to the comprehension and evaluation of emerging technologies within healthcare.

PROFESSIONAL/PRACTICAL SKILLS

- P1 Plan for the deployment of health informatics solutions using tools and services currently available.
- P2 Relate professional, legal, moral and ethical issues to health informatics.
- P3 Use commonly available software tools to support healthcare delivery.

TRANSFERABLE SKILLS

- T1 Communicate effectively using various forms of media and with a variety of audiences.
- T2 Manage one's own learning and development including time management and organizational skills.

CONTENT

Background and need for health informatics

- Clinical needs- diagnostic, therapeutic
- Patient needs- life style, patient perceptions
- External factors- demographics, governmental influences
- Relationship between stakeholders- trends in patient-doctor interaction
- Ethical considerations

Medical Data

- Introduction to medical data
- Storing patient data (integrity, security)
- Data processing
- Electronic patient records

Infrastructures to support care delivery

- Internet and the web
- Mobile communications
- Thin client and thick client models (three tier architecture)
- Standards

Existing health informatics solutions and devices

- Patient monitoring systems and mobile devices
- Decision support
- E-services
- Systems for medical education

TEACHING AND LEARNING METHODS

Lectures, seminars and tutorials will be offered to the whole cohort on the topics as outlined above. As the topics are introduced during the lectures students will be expected to apply the knowledge gained within the seminars and tutorials associated with the module.

Seminars will be conducted to discuss practical examples of ubiquitous health informatics solutions and will offer the ability for students to interact with tangible working systems within the main topic domains of study.

Students will be directed to read through the relevant sections of the notes, recently published articles and/or textbooks before the lectures/seminars/tutorials. They will also be expected to attempt all tutorial questions and to complete any unfinished practical problems outside of class time before their next practical session. Practical exercises will be designed to expose students to techniques and tools that are sound examples of the use of technology in healthcare.

The module is web dependent. All materials related to the module will be made available via a dedicated module web site where regular messages relating to the module will also be posted.

ASSESSMENT

Assessment for the module is based on a series of Coursework Assignments as follows:

1. Learning Log
2. Investigative study of existing approaches in health informatics.
3. Design and Development of an Internet based solution to support healthcare delivery.

Coursework1: Learning Log

Students will be required throughout the duration of the course to maintain a learning log of their activities associated with the module. This should be published online and will exploit a wide range of currently available media. The material will be assessed on a bi-weekly basis for the entire duration of the module.

This will measure the student's achievement of module learning outcomes: I2, P2, I3, T1, T2. (20%).

Coursework 2: Investigative study of existing approaches in health informatics

In Week 7 students will be required to deliver a report which will present the results of their findings following an investigative study. Students will be provided with a topic for consideration during Week 2 and will be asked to investigate this topic as an existing health informatics solution.

This will measure the student's achievement of module learning outcomes K1, I1, I2, I3, I4, T1, T2. (30%).

Coursework 3: Design and Development of an Internet based solution to support healthcare delivery

In Week 12, students will be asked to present their results from a group based assignment which will have addressed the design and deployment of an Internet based solution for a specific healthcare delivery issue. In addition to an operational demonstration students will be required to provide an oral presentation of their work and defend the key elements of their results. Students will be expected to demonstrate prototypes exploiting Internet and mobile technologies.

This will measure the student's achievement of module learning outcomes K1, K2, I1, I3, P1, P3, T1. (50%).

EXAMINATION

A 3-hour paper with between 5 and 8 questions in which there will be an element of choice. Learning outcomes K1, K2, I1, I2, I4. will be assessed.

50% Coursework

50% Examination

READING LIST

Required

J van Bommel and MA Mussen (1997), Handbook of Medical Informatics, Heidelberg, Springer.

R.G. Bushko (2002), Future of Health Technology, Amsterdam, IOS Press.

Recommended

IEEE Engineering and Biology in Medicine Magazine

IEEE Transactions on Information Technology in Biomedicine

SUMMARY DESCRIPTION

This module provides an understanding of the technology used in various healthcare applications. This module will provide students with a firm understanding of health informatics.

MODULE TITLE:	Emerging healthcare technologies	
MODULE CODE:	COM725J2	
DATE OF REVISION:	2007/8	
MODULE LEVEL:	7	
CREDIT POINTS:	15	
MODULE STATUS:	Compulsory for P G Dip in Computing (Health Informatics)	
	Optional for P G Dip in Computing P G Dip in Computing (Communications) PG Dip in Computing (Web Technology) P G Dip in Computing (Artificial Intelligence)	
SEMESTER:	2	
LOCATION:	Jordanstown	
E-LEARNING:	Web dependent	
PREREQUISITE(S):	None	
CO-REQUISITE(S):	None	
MODULE CO-ORDINATOR(S):	Dr D Finlay	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY:	Dr C Nugent, Dr D Finlay	
HOURS:	Lectures	WebCT 10 hours
	Seminars	Face to face & Web CT 5 hours
	Tutorials	Web CT 10 hours
	Practicals	Face to face 10 hours
	Independent study (including assessment)	115 hours
TOTAL EFFORT HOURS:		150 hours
ACADEMIC SUBJECT:	COM	

RATIONALE
This module provides an understanding of the use of technology in healthcare. Particular emphasis is placed on new and emerging applications of technology in this domain. This shall be realised through analysis of technologies which are currently pervasive in healthcare provision and through the investigation of new and emerging technologies. The module shall provide a framework to facilitate the development and understanding of technology and service provision for healthcare using a range of technologies new and old from both theoretical and practical perspectives.

AIMS

To assist the student to:

1. carry out a significant investigation of the different technologies used in healthcare provision
2. understand the need for technical solutions in healthcare applications
3. investigate the state of the art in healthcare technologies
4. demonstrate examples of how the internet and mobile technologies can be used as platforms to enhance healthcare delivery
5. to research various service platforms
6. develop the ability to work independently and collaboratively with fellow students

LEARNING OUTCOMES

A successful student will be able to show that he/she can:

KNOWLEDGE AND UNDERSTANDING

K1	demonstrate a sound understanding of the fundamental concepts, principles, theories and practices underlying the use of technology for healthcare applications
K2	critically evaluate, from a computing science perspective, current approaches to healthcare delivery
K3	effectively deploy technologies and tools to provide solutions for healthcare delivery

INTELLECTUAL QUALITIES

I1	Identify and hypothesise about contemporary healthcare technologies to support the modelling and abstraction of data pertaining to the requirements of a specific problem
I2	Formalise and articulate a logical argument for the adoption of technology in healthcare
I3	Structure ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences
I4	Apply the fundamentals of computing science to the comprehension and evaluation of emerging technologies within healthcare

PROFESSIONAL/PRACTICAL SKILLS

P1	Plan for the deployment of healthcare technology using tools and services currently available
P2	Use commonly available internet based tools to support future healthcare technologies
P3	Communicate effectively technical information to technical, management, user, and academic audiences
P4	Effectively manage information resources using appropriate tools and techniques

TRANSFERABLE SKILLS

T1	Discuss and defend actions and opinions
T2	Communicate effectively using various forms of media and with a variety of audiences
T3	Effectively use general information technology facilities
T4	Manage one's own learning and development including time management and organizational skills

CONTENT

Introduction to technology in healthcare, need for technology in healthcare and stakeholder involvement

Examples of current techniques, approaches and utility (telemedicine, telecare, biomedical engineering)

Existing tools and technologies in healthcare

- Hardware components: computer architectures, networks

- Internet and the web (Care models)

- Web site design principles

- Netiquette

Medical devices (Patient monitoring, assistive technologies)

Healthcare administration tools (billing tools, prescribing tools etc)

Novel applications of the internet and web

Wearable and pervasive computing and smart textiles

New and emerging technologies

Mobile devices and M-health

eInclusion

Smart Environments

Behavioural analysis and data management

Development and deployment of healthcare technologies

Evaluation of current systems, Barriers to uptake

The content of the module will be regularly reviewed and updated to ensure its currency

TEACHING AND LEARNING METHODS

Lectures, seminars and tutorials will be offered to the cohort on the topics as outlined above. As the topics are introduced during the lectures students will be expected to apply the knowledge gained within the seminars and tutorials associated with the module.

Seminars will be conducted to discuss practical examples of emerging healthcare technologies and will offer the ability for students to interact with tangible working systems within the main topic domains of study. Formative assessment will be provided by WebCT.

Students will be directed to read through the relevant sections of the notes, recently published articles and/or textbooks before the lectures/seminars/tutorials. They will also be expected to attempt all tutorial questions and to complete any unfinished practical problems outside of class time before their next practical session.

Practical exercises will be conducted within a customised smart environment for emerging healthcare technologies. Due to the restricted size of this environment (2 operational rooms) the size of the entire cohort will be limited to 16 to facilitate 4 working groups of 4 persons during each experiment. Students will be provided with the opportunity to establish smart environments to record behavioural data, to establish the necessary infrastructures to support recording of vital signs through mobile technologies in addition to design advanced Internet based systems for care models. Where the module enrolment is larger than 16 repeat sessions will be possible.

The module is web dependent. All materials related to the module will be made available via WebCT where regular messages relating to the module will also be posted.

ASSESSMENT

Assessment for the module is based on a series of Coursework Assignments as follows:

1. Learning Log
2. Investigative study of existing & emerging healthcare technologies
3. Systems Design of technologies to support healthcare delivery

Coursework1: Learning Log

Students will be required throughout the duration of the course to maintain a learning log of their activities associated with the module. This should be published online and will exploit a wide range of currently available media. The material will be assessed on a weekly basis for the entire duration of the module.

This will measure the student's achievement of module learning outcomes K2, I2, I4, P3, P4, T2, T3, T4 (20%).

Coursework 2: Report delivered by WebCT. Investigative study of existing & emerging healthcare technologies. Students will be required to deliver a report which will present the results of their findings following an investigative study. Students will be provided with a topic for consideration during Week 2 and will be asked to investigate the potential of this topic as an emerging technology within the healthcare domain, to identify barriers to its success and to provide a short summary of any results in the area to date. Topics for consideration will be largely guided by the state-of-the-art developments on a year by year basis within healthcare technologies.

This will measure the student's achievement of module learning outcomes K1, K2, I3, I4, P3, T1, T2, T4 (30%).

Coursework 3: Systems Design of technologies to support healthcare delivery

Students will be asked to present their findings from a group based study which will have addressed the design and deployment of technologies to support healthcare delivery within a specific topic. Each group will be requested to present a design document for the deployment of the technology in addition to the delivery of an oral presentation which they must also defend. In the first instance the work submitted by each group will be assessed prior to the oral presentation and has the potential of being awarded a maximum of 75 marks. A further 25 marks are available to be allocated to each student, on a student per student basis following assessment of their presentation and defence of the ensuing questioning. Each group will also be given the opportunity during the presentation to comment on the input by each group member. This will also be taken into account when awarding marks.

This will measure the student's achievement of module learning outcomes K1, K3, I1, I4, P1, P2, P3, T1, T2, T3 (50%).

100	% Coursework		% Examination
-----	---------------------	--	----------------------

READING LIST

Required

RSH Istepanian, S Laxminarayan, CS Pattichis (2006), M-Health: Emerging Mobile Health Systems, New Jersey, Springer.

CD Nugent, PJ McCullagh, ET McAdams, A Lymberis (2005), Personalised Health Management Systems: The Integration of Innovative Sensing, Textile, Information and Communication Technologies, Amsterdam, IOS Press.

R.G. Bushko (2002), Future of Health Technology, Amsterdam, IOS Press.

Recommended

General reading of the following published journals is suggested:

IEEE Pervasive Computing Magazine

IEEE Engineering and Biology in Medicine Magazine

Pervasive and Mobile Computing Journal

IEEE Transactions on Information Technology in Biomedicine

SUMMARY DESCRIPTION

This module provides an understanding of the technology used in various healthcare applications. Existing and emerging aspects of this technology are investigated and tools to assist healthcare delivery are assessed.

MODULE TITLE:	Dissertation	
MODULE CODE:	COM878J4	
DATE OF REVISION:	2007/8	
MODULE LEVEL:	7	
CREDIT POINTS:	60	
MODULE STATUS:	Compulsory for M Sc in Computing M Sc in Computing (Communications) M Sc in Computing (Web Technology) M Sc in Computing (Artificial Intelligence) M Sc in Computing (Health Informatics)	
SEMESTER:	Full-time Semester 3 / Part-time Semesters 1-2	
LOCATION:	Jordanstown	
E-LEARNING	Web supplemented	
PREREQUISITE(S)	COM916J2 Research Methods	
CO-REQUISITE(S)	None	
MODULE CO-ORDINATOR(S):	Lundy PJ	
TEACHING STAFF RESPONSIBLE FOR MODULE DELIVERY	Lundy PJ + Dissertation Supervisors	
HOURS:	Lectures	0 hrs
	Seminars	4 hrs
	Supervisory Meetings	16 hrs
	Tutorials	0hrs
	Practicals	0hrs
	Independent study (including assessment)	580 hrs
TOTAL EFFORT HOURS:	600	
ACADEMIC SUBJECT:	COM	
MODULAR SUBJECT:	N/A	

RATIONALE

Undertaking and presenting a dissertation provides students with the opportunity of developing their interests in Computing Science through research and investigation of a specified topic. It also gives students an opportunity to integrate and extend what they have learned in taught modules and to innovatively apply their understanding of well-established and emerging techniques to the solution of an academic or industrial problem

AIMS

The aims of the dissertation module are to extend the students' knowledge and to equip them to conduct a valid investigation into a computing-related problem, based on analysis of a problem domain, assessment of current knowledge and use of relevant information technology to develop and evaluate a computer-based solution that furthers current knowledge or industrial practice.

LEARNING OUTCOMES

A successful candidate will be able to show that he/she can:

KNOWLEDGE AND UNDERSTANDING

- K1 Demonstrate a mature understanding of software lifecycle options for developing software-based tools or prototypes to further an investigation into a computing related problem.
- K2 Demonstrate a mature understanding of the current level of knowledge in the subject area of the dissertation.

INTELLECTUAL QUALITIES

- I1 Identify a problem, specify the objectives and formulate an approach for solving the problem.
- I2 Analyse current knowledge regarding a problem to place it in both its theoretical and practical context and to identify common threads, differences and gaps in current literature or practice.
- I3 Develop an innovative and justified approach to creating a solution to the problem
- I4 Evaluate the practical benefits and limitations of the solution and of the research and development methods used.

PROFESSIONAL/PRACTICAL SKILLS

- P1 Design, construct and test a substantial software artefact.

TRANSFERABLE SKILLS

- T1 Communicate through reports and presentations the aims, process, results and limitations of an investigation.
- T2 Apply project management techniques to programme of work.
- T3 Act ethically as a computing professional.
- T4 Manage their own learning and professional development.

CONTENT

Investigation of a problem that is relevant to the candidate's work and/or related to a university research group. The topic will normally relate to the subject of at least one of the modules offered on the course.

(Students will have completed some work -- a preliminary proposal, background research and literature review -- in the Research Methods module.)

TEACHING AND LEARNING METHODS

A member of academic staff will be assigned to each student as dissertation supervisor. The academic supervisor will provide expert support as appropriate and recommend links with other sources of academic and industrial input. In addition to the individual supervisors, a dissertation co-ordinator will provide a schedule and provide guidance on methodology, written presentations and on the submission of the final thesis

Students and supervisors will meet at regular intervals to ensure that students receive clear guidance during the progress of the dissertation.

Supervisory meetings will be supplemented by seminars.

The module is web supplemented.

ASSESSMENT

Full-time and part-time students will normally begin work on the dissertation at the beginning of Semester 3 of Year 1 and the beginning of Semester 1 of Year 3 respectively. Full-time students will normally submit the dissertation by 30 September and part-time students by 30 April.

The schedule for submission of various items of work is as follows:

1. An initial report specifying the aim of the work and reviewing the literature in the field.
2. An interim report on the progress of the work submitted midway through the Dissertation schedule.
3. A final project report with appendices. The project report should be in the form of a research paper, 15 – 20 pages in length, excluding references and appendices. The appendices should complement the report by providing additional detail on the problem, research approach, software development and evaluation of the work. The report and appendices should not exceed 20,000 words.
4. A presentation on the project including demonstration of any software developed.
5. A poster summarising the work. The poster should be of a standard suitable for submission to the poster stream of an academic conference.

The allocation of marks to various items of work is as follows:

- | | |
|---|------|
| 1. Initial Report (5000 words) | 10% |
| 2. Interim Report (1000 words) | 5% |
| 3. Project report & Appendices (6000 words) | 70 % |
| 4. Presentation (20 minutes) | 10% |
| 5. Poste (A1 size)r | 5% |

The Dissertation will measure the student's achievement of learning outcomes K1, K2, I1-I4, P1 and T1-T4.

100% Coursework

0% Examination

READING LIST

Preece, RA, 1994, *Starting research: an introduction to academic research and dissertation writing*, London, Pinter Publishers.

Rudestam, KE, 2001, *Surviving your dissertation: a comprehensive guide to content and process*, London, Sage.

Mauch, JE, 1998, *Guide to the successful thesis and dissertation, 4th Ed Rev*, New York, M Dekker.

University of Ulster General University Masters Degree Dissertation Guidelines.

SUMMARY DESCRIPTION

The dissertation provides an opportunity for students to apply what they have learned in the taught modules to a substantial investigation of a computing problem. The work results in a detailed written research report and, normally, an associated software system.

SECTION C: PROGRAMME MANAGEMENT

C1: Equality of Opportunity, Admissions Policy and Special Educational Needs and Disability Order (SENDO)

C1.1: Equality of Opportunity

The University of Ulster has a clearly articulated policy for Equality of Opportunity. The Charter of the University Section 28 states:

'Persons shall not be excluded by reason of religious belief, political opinion, race or sex from admission as Members or employees of the University or from office or employment therein or from any advantage or privilege thereof; preference shall not be given to or advantage be withheld from any person on grounds of religious belief, political opinion, race or sex; and the religious beliefs of Members and employees of the University shall be treated with due respect.'

All School of Computing and Mathematics staff are aware of their responsibility to comply with the Equality of Opportunity policy as it applies to programmes of study.

C1.2: Admissions Policy

Entry to the programme is subject to the Admission Requirements detailed in Section 6 of Course Regulations. This includes provision for admission of candidates who are able to provide a portfolio of work which demonstrates the meeting of graduate qualities and subject-specific learning outcomes equivalent to an honours degree in computing.

C1.3: Special Educational Needs and Disability Order

The Special Educational Needs and Disability Order, which came into effect on September 1st 2005, places a duty on the University to anticipate and make reasonable adjustments to facilitate access to education and associated services by disabled students. The guiding principle behind the legislation is that disabled people should have the same opportunities as non-disabled people to benefit from whatever education or other related provision is available. The general responsibilities which follow from this principle are

- to anticipate the needs of disabled students
- to make reasonable adjustments in order to facilitate access to education and other services.

School staff have attended staff development sessions on compliance with SENDO and are well aware of their responsibilities as facilitators of teaching and learning.

C2: Programme Management

In accordance with the standard university practice, the responsibility for the management of the programme lies variously with the

- Course Committee
- Course Director
- Module Coordinators

and ultimately with the Head of School.

C2.1: Course Committee

The Course Committee includes all members of the academic staff who make a significant contribution to the teaching of the course, the Head of School and the Dean of the Faculty of Computing and Engineering (ex-officio).

The Course Committee's role is

- a) To advise and report to the Faculty Board on:
 - i) all matters relating to the organisation of teaching, including curricula and examinations, in the course;
 - ii) the effective and efficient use of resources for the course
 - iii) the progress and conduct of students on the course
 - iv) the establishment of an effective form of consultation between staff and students on the course;
 - v) such other matters as may be determined by the Faculty Board.
- b) To submit to the Faculty Board nominations for the appointment of external examiners for the course
- c) To submit to the Faculty Board annual reports on the operation of the course including reports submitted by external examiners.
- d) To consider evidence of extenuating circumstances presented by students in relation to performance in assessment in semester one and to decide, on behalf of Senate, whether to permit them to take the assessment as for the first time.
- e) To consult with other course committees on matters of mutual interest or concern.

The Course Committee meets regularly – at least twice in Semesters 1 and

2 and once in Semester 3 – to conduct its business including review of student performance.

The university has facilitated personal development planning by commissioning an interactive tool available online at <http://opus/ulster.ac.uk/pds>. Students are informed about personal development planning at induction and encouraged to use the online tool to plan and reflect on their intellectual, technical and professional development during the course of studies.

C2.2: Course Director

The Course Director is responsible to the Board of the Faculty of Engineering for the organisation and Management of the course. In particular the Course Director:

- i) acts as Chairman of the Course Committee;
- ii) in consultation with Head(s) of School as appropriate, keeps under review the provision of human and physical resources for the course;
- iii) liaise with Heads of School to ensure that a Module Co-ordinator is appointed for each course module;
- iv) ensures that the course committee carries out its functions as approved by Senate and is responsible in collaboration with other members of the Course Committee for:
 - a) preparation of course publicity material and co-ordination of the Course Committee's contribution to the University's overall course publicity programme;
 - b) ensuring that information held on the module database is updated to take account of revisions which affect the modules taught in the course [see also below];
 - c) oversight of the selection of applicants in accordance with the University's admission policy;
 - d) the timetabling of the course;
 - e) arrangements for student induction programmes, including the preparation and distribution of course handbooks and other material to students;
 - f) ensuring that students are adequately informed of both general health and safety matters and those specific to their course of study and for communicating relevant information to them;

- g) in consultation with the Head of School, allocation of advisers of studies to students;
- h) the regular review of student attendance and progress and presentation of reports on these matters to the Course Committee, (including evidence of extenuating circumstances submitted by students in relation to performance in examinations and assessment in semester one), and to the Faculty Board in respect of students deemed withdrawn on account of non-attendance for an (aggregate) period of four weeks;
- i) implementation of the Course Committee's decision regarding the method of staff/student consultation;
- j) submission to the Faculty Board of nominations for the appointment of external examiners;
- k) collation of draft examination papers and collaboration with external examiners in the approval and moderation of examination papers and coursework;
- l) consideration of requests for permission for late submission of coursework;
- m) arrangements for meetings of Boards of Examiners and for the attendance of external examiners;
- n) arrangements for the preparation of students' results profiles for presentation to the Board of Examiners;
- o) communicating to unsuccessful students the Board of Examiners' decisions about their performance and progress;
- p) preparation for consideration by the Course Committee of a draft response to the report(s) of external examiner(s);
- q) preparation and submission of appropriate documentation, for initial consideration by the Course Committee, for annual subject monitoring and re-validation and for proposed revisions to the course;
- r) with the approval of the Dean, arrangements for liaison with external bodies.

The Course Director undertakes such other duties as the Board of the Faculty may specify.

C2.3: Module Co-ordinator

Each module has a Module Co-ordinator who is appointed by the Head of School and who has overall responsibility for the module. Staffing within a

module is the responsibility of the Head of School. Where a module is taught on more than one campus a co-ordinator will normally be appointed for each campus.

The main responsibilities of the Module Co-ordinator are:

- planning the module and changes to the module
- co-ordinating and managing teaching on the module
- co-ordinating the examining of students on the module

though in cases where a module is delivered by more than one member of staff some responsibilities will be shared.

1: Planning the Module and Changes to the Module

The Module Co-ordinator:

- a) in respect of a new module, provides the course/subject planning committee with the details of the new module (e.g. title, level, credit points, aims and objectives, learning outcomes, teaching and learning methods, description, assessment, reading list) for inclusion in the course document;
- b) in respect of changes to an existing module, in consultation with the Course/Subject Director(s), completes and submits to the Faculty for approval a CA3 form setting out the proposed changes.

(Note: The Course/Subject Director is responsible for providing Academic Registry with information required for new courses or Honours subjects and provision undergoing re-validation).

2 Co-ordinating and Managing Teaching on the Module

- a) Modules may be taught entirely by one member of staff (who is the Module Co-ordinator) or by a team of lecturers headed by a Module Co-ordinator. The Module Co-ordinator in the former case or the lecturing team in the latter case is responsible for:
 - preparing and delivering lectures, seminars, tutorials and practicals in accordance with the syllabus;
 - preparing handouts for students covering the syllabus, timetable, reading list, assessment requirements, library arrangements and procedures for contact with students (see Appendix 27);
 - ensuring that the library, computer services and the bookshop have been made aware of the requirements for the module;

- monitoring student attendance and progress and advising the Course/Subject Director and adviser of studies of any problems; and
 - attending meetings of the course/subject committee;
- b) Where more than one member of staff delivers the module, the Module Co-ordinator:
- convenes periodic meetings with the module team to plan teaching, to review assessment procedures and examination marks, etc.;
 - provides support for less experienced staff;
 - represents the views of the module team at relevant meetings; and
 - circulates to the module team relevant information.

3 Co-ordinating the Examining of Students on the Module

The module team, where more than one member of staff delivers the module, or the Module Co-ordinator, where the module is delivered by only one member of staff, is responsible for:

- a) marking and return of coursework assignments to students with comments and marks/grades; and
- b) marking examination scripts and arranging for double marking or other moderation where required.

The Module Co-ordinator is responsible for:

- a) preparation of the draft examination paper for submission to the Course/Subject Director for approval by the external examiner;
- b) submission of approved examination papers to the Head of School or to the Examinations Office on behalf of the Head of School;
- c) liaising with Student Support and advising the Course/Subject Director(s) of special examination requirements if appropriate;
- d) submission of coursework and examination marks to the Examinations Office by the specified deadline;
- e) notification to the Course/Subject Director(s), in person or by telephone, of any amendments to the provisional marks of a student so that these will be available to the course/subject

committee/board of examiners together with notification to the Examinations Office in writing of the amendments;

f) attendance at meetings of course/subject committees and boards of examiners and reporting on student performance where required.

4 Module Monitoring

The Module Co-ordinator is responsible for contributing to the module monitoring process.

C3: Student Support and Guidance

C3.1 Programme Handbook

At the beginning of each year, the Faculty of Engineering gives out a CD containing a programme handbook to all students. This CD contains faculty information, campus information, programme information and the following categories of general information for students:

Teaching, Learning and Assessment

- Teaching and Learning Approaches

- Teaching Methods

- Assessment and Examinations

- Assignment Proforma and Submission Guidelines

- Faculty Attendance Policy

- Illness

- Early Withdrawal from the Course

Study Guide

- Time Management

- Study Management

- Taking Lecture Notes

- Reading for Study

- Preparation and Presentation of Examinations

- References and Bibliography

- Oral Presentations

- Preparation for Examinations

Personal Development Planning

Behaviour Guide

- Acceptable Behaviour

- Plagiarism

- Living Off Campus

Notes for Students

University Contacts

Student Support

- Academic Registry

- Finance

Students Union
Library
IT User Services
Careers Services

Student induction is centred on the programme handbook CD. Programme Specification, Course Regulations, Module Descriptions and other information about the course (e.g. contact details, timetable etc) is also placed on the course web page at http://www.infj.ulst.ac.uk/~cbdq23/admin/pgd_msc_computing.html.

C3.2: Module Handouts

Students have access to module descriptions from several sources:

- course web page
- module web page
- printed copies, usually given out at first meeting of a class.

This is supplemented by

- guidance on completion of coursework,
- directed reading, and
- guidance on preparation for examination

provided by module co-ordinators in the course of their teaching duties. Most module coordinators maintain a web page which contains this information and effectively serves as the module handout.

C3.3: Studies Advice

Given the relatively small numbers on the course and the ethos of personal acquaintance and interaction that develops, the Course Director also serves as the Studies Advisor for PG Cert in Computing and PG Dip / M Sc in Computing (*with or without specialism*) students. This has the added advantage that much of University's and Faculty's Code of Practice for Advisers of Studies is followed automatically (e.g. the recommendation that 'Advisers of Studies make themselves conversant with the academic and personal background of their students').

Students are advised and encouraged to approach the Course Director if they encounter personal or academic difficulties which (may) impinge on their performance. As and when necessary, the Course Director refers the students to the Faculty Studies Advisor for more specialised help. The Faculty Studies Advisor may, in turn, refer them to the university's Student Support services.

Student Support services offer specialised professional support in the following areas:

- Child Care
- Counselling / Mental health
- Disability
- Health
- Student Finance.

University's Code of Practice for Advisers of Studies can be found at Appendix 30 of the *Programme Approval, Management and Review Handbook* (July 2007).

Course Director introduces the students to the university's online tool for personal development planning during induction and acts as their PDP advisor throughout the course of their studies.

Students are required to attend all classes. Where a student misses more than the odd class, module co-ordinators bring it to the attention of the Course Director who follows it up with the student .

C4: Quality Assurance and Enhancement

The issue of quality and rigour in the development and provision of degree programmes has taken on a greater significance since the publication of the Dearing Report in July 1997. The following quality assurance mechanisms are in force for this programme of study:

C4.1 Teaching Quality

Staff on this postgraduate programme are committed to achieving high standards in teaching. The Schools accept the need to be pro-active in pursuit of teaching quality and are committed to the principles of quality assurance and enhancement within the QAA framework.

The University has also developed its own internal teaching quality enhancement programme. This is communicated through the University's Teaching and Learning Strategy, which identifies the twin aims of:

Achieving teaching excellence; and
Fostering and disseminating innovative teaching practices.

The strategy recognises the importance of the individual teacher and of collaboration in the development of innovations and the dissemination of best practices. As a result of this strategy and in response to the external demands, a self and peer observation of teaching programme has been developed as a mechanism for helping staff to achieve enhanced performance in teaching and learning through observation, feedback and discussion with a peer (see below).

Newly appointed academic staff who do not have any previous training in teaching and learning support activities are encouraged to undertake the

University's Postgraduate Certificate in University Teaching (administered from the School of Education), to develop their pedagogic and related skills. Heads of School formally report on the teaching and examining performance of staff on probation. Part-time lecturing staff are encouraged to participate in appropriate Staff Development courses. Postgraduate and research students who wish to become involved in teaching and assessment are required to attend these courses.

C 4.2 : Student Feedback on Teaching Quality

The University issues questionnaires to students on an annual basis so that they may record their views on the quality of teaching experienced. Comment is invited on a wide range of issues including the suitability of the location, the relevance of reading lists, the teacher's style of delivery, use of handout materials and teaching aids, and the speed of return of assignments.

Each lecturer and his or her Head of School are informed of the outcome so that appropriate exchanges can take place. Staff have come to value the feedback which the system provides. Summary analyses for Schools, Faculties and the University as a whole are provided.

C4.3: Staff / Student Consultation

The Staff / Student Consultative Committee is the forum where students are able to bring for discussion matters of concern which are unsuitable for discussion with module co-ordinators or Course Director individually. The Committee is chaired by the Course Director and meets once every term. Normally the membership includes two student representative from each cohort, the Course Director and all teaching staff.

C 4.4: Course Revalidation

University regulations require that each course is critically appraised on a periodic basis. In effect, this process allows each planning team to review the operation of the course since its last appraisal and to make such amendments as are found to be necessary.

C4.5: Annual Subject Monitoring

The Annual Subject Monitoring exercise provides the Faculty with an opportunity to:

- Review the performance of Programmes and Subjects in the context of Faculty and University objectives;
- Monitor student achievement and progression;
- Identify issues for further action and enhancement;
- Identify and share good practice between Subjects.

At the programme level, each programme submits a written report which demonstrates critical evaluation of:

- Key issues raised at Staff/Student Consultative Committee meetings;
- External Examiner's reports indicating responses to key issues raised by the External examiner and subsequent action
- Programme developments, the rationale for these and anticipated benefits
- Identification of possible risk to the program;
- Action plan summarising planned enhancement activity and detailing timescales, responsibilities and how progress will be monitored.

C4.6: External Examiner

The External Examiner is appointed by Council on the recommendation of the University Teaching and Learning Committee after consideration of nominations from the Faculty. His/her main duties are:

- approval and moderation of examination papers and other forms of assessment;
- consideration of the standard of marking of examination papers and other forms of assessment and reporting to the Board of Examiners on such revisions of the marking as are considered necessary;
- submission to the Pro-Vice-Chancellor responsible in the first instance of reports on: the standards of the course; the standards of assessment; the standards of student performance; and the comparability of the standards with those of similar courses; and the assessment schemes and processes, taking in account the relevant national subject benchmarks and the national qualifications framework.

External Examiner's input is the main, and much valued, mechanism for assurance of continued comparability with similar programmes at other UK universities.