Faculty of Computing, Engineering & Mathematical Sciences

Postgraduate Scheme

PART 1

1. Basic Data

Awarding Institution	University of the West of England, Bristol
Teaching Institution	University of the West of England, Bristol
Faculty	Faculty of Computing, Engineering & Mathematical Sciences
Professional Accreditation	The MSc Information Technology is accredited by the British Computer Society.
Target Award Title	MSc Advanced Technologies in Electronics MSc Engineering & Technology Management MSc Software Engineering MSc Computer Science MSc Statistics & Management Science MSc Information Technology
Other award titles	None
Interim Award Titles	Postgraduate Certificate in Advanced Technologies in Electronics Postgraduate Certificate in Engineering & Technology Management Postgraduate Certificate in Software Engineering Postgraduate Certificate in Computer Science Postgraduate Certificate in Statistics & Management Science Postgraduate Certificate in Information Technology Postgraduate Diploma in Advanced Technologies in Electronics Postgraduate Diploma in Engineering & Technology Management Postgraduate Diploma in Software Engineering Postgraduate Diploma in Computer Science Postgraduate Diploma in Statistics & Management Science Postgraduate Diploma in Information Technology
Modular Scheme	The Modular Scheme of the Faculty of Computing, Engineering & Mathematical Sciences
QAA Subject Benchmarking Group	Computing; Engineering; Mathematics, Statistics & Operational Research

2. Educational Aims of the Scheme

The educational aims of the scheme are:

a) to provide an intellectual experience of advanced study, underpinned by staff expertise, research, and experience.
b) to enable the student to further and deepen his/her knowledge, understanding and analytical abilities in a stimulating and challenging academic environment,
c) to prepare the student for further professional development in his/her chosen field
d) to develop the student's ability to conduct research in their chosen field;
e) to offer postgraduate opportunities for part-time students in employment.

Different awards fulfil these aims in different ways, as described in the section relating to the learning outcomes for each award.

3. Learning Outcomes of the Scheme

Each award within the scheme has learning outcomes within a common framework of outcomes which relate to

- knowledge and understanding;
- subject-specific skills;
- cognitive skills;
- transferable skills.

The specific outcomes for each award are as shown in a later section; sections 3.1 - 3.4 describe the outcomes which a student is typically expected to achieve.

3.1. Knowledge and Understanding

Typically, a student will be expected to:

- have acquired a substantial range of knowledge in their specialised area and/or across specialised or applied areas of the discipline;
- understand the analytical and problem solving approaches needed for the area of their award;
- implement the research process, coupled with understanding and application of appropriate research methods.

3.2. Subject-specific Skills

The subject-specific practical skills developed in each award are considered in that award's volume.

3.3. Cognitive Skills

The faculty expects work at postgraduate level to differ from undergraduate work not only in depth of knowledge or mastery of skills, but also through depth of cognitive skill. This may be expressed by, for instance, the ability:

- to analyse complex, unpredictable and demanding problems;
- to reflect critically on one's own learning towards identifiable objectives;
- to evaluate existing knowledge or techniques and to assess opportunities for expansion or development;
- to work autonomously in a professional context.

The award-specific learning outcomes reflect these expectations in respect of the cognitive skills achieved within each award.

3.4. Transferable Skills

The faculty has a policy regarding transferable skills, under which each module and each award is expected to include one or more skills from the faculty's definition of transferable skills, as shown below. The purpose in doing so is to increase students' effectiveness as learners and to enhance their prospects of employment. The skills include those which are complementary to the disciplines concerned as well as skills which are independent of the discipline, and are consistent with the expectations of QAA's "*Framework for Higher Education Qualifications".*

Communication Skills (to communicate orally or in written format, including for instance the results of technical investigations, to peers and/or to 'problem owners')

Self-management Skills (to manage one's own time; to meet deadlines; to work with others)

IT Skills in Context (to use software in the context of problem-solving investigations, and to interpret findings)

Problem Formulation and Decision-making (to express problems in abstract terms; to undertake analysis and interpretation in the context of the discipline; to interpret the results of findings in appropriate terms)

Progression to Independent Learning (to gain experience of and to develop skills in learning independently of structured classroom work)

Awareness of Professional Literature (to be aware of, and where appropriate to read and to use literature sources relevant to the discipline to support learning activities)

Working with Others (to be able to work as a member of a team; to be aware of the benefits and problems which teamwork can bring)

Not every module includes each skill, but the core modules within each award between them ensure coverage of all skills.

4. Structure & Credit Requirements

There are six named awards within this scheme:

[180 credits are required to qualify for the award of an MSc]

MSc Advanced Technologies in Electronics
MSc Engineering & Technology Management
MSc Software Engineering
MSc Computer Science
MSc Statistics & Management Science
MSc Information Technology

and the structure of each these is as shown in the diagrams on the following pages.

The following Interim Awards are also available: -

[60 credits are required to qualify for the award of a Postgraduate Certificate]

Postgraduate Certificate in Advanced Technologies in Electronics
Postgraduate Certificate in Engineering & Technology Management
Postgraduate Certificate in Software Engineering
Postgraduate Certificate in Computer Science
Postgraduate Certificate in Statistics & Management Science
Postgraduate Certificate in Information Technology

[120 credits are required to qualify for the award of a Postgraduate Diploma]

Postgraduate Diploma in Advanced Technologies in Electronics
Postgraduate Diploma in Engineering & Technology Management
Postgraduate Diploma in Software Engineering
Postgraduate Diploma in Computer Science
Postgraduate Diploma in Statistics & Management Science
Postgraduate Diploma in Information Technology

Each programme is designed to be followed by full-time study over one year or by part-time study over two years. For each programme there is accordingly a structured part-time route comprising 30 credits of taught modules per semester for four semesters followed by a dissertation module. Within three of these awards, structured pathways have been designed in order to inform student choice by bringing together modules within a specific discipline area. The pathways identified thus far are

MSc Engineering & Technology Management
- Machine Vision & Computer Graphics
- Mechatronics
- Engineering Design Analysis
- Rapid Product Realisation

MSc Computer Science
- Adaptive Computing
- Complex Systems

MSc Information Technology
- Business Information Systems
- Community Information Systems
- The Learning Society
- Manufacturing & Design
- Software Development
- Total Quality Management

The faculty intends to ensure that these pathways are available and are timetabled in a manner which will facilitate participation and attendance by part-time students.

The interim awards of Postgraduate Certificate and Postgraduate Diploma are available to students on each programme. The credit requirements for interim awards are as detailed in the University's Modular Assessment Regulations. Within each programme any combination of modules to the required number of credits is sufficient for an interim award. [please refer to page 1, Basic Data Section for a complete listing of the awards available under the new scheme.]

Learning Outcomes for MSc Advanced Technologies in Electronics

All students of Advanced Technologies in Electronics will attain the learning outcomes given in the following sections. Students develop additional focused technical skills, depending upon their option choices

A. Knowledge and Understanding

Knowledge and Understanding of:	**Teaching/Learning Methods and Strategies**	**Assessment**
1. The fundamental features of intelligent and adaptive systems. UFE018QM 2. The components of Communication Networks and the protocols and algorithms used in their implementation. UFE018QM CommNetProt 3. The nature of the research process and the range of research methods available. UFQ007QM ResMethods 4. The critical features of advanced multitasking Embedded Real-Time Systems	On all modules the learner is encouraged to undertake independent reading both to supplement and consolidate what is being learnt and to broaden their individual knowledge of the subject. The dissertation then builds on this knowledge providing an opportunity for an in-depth study of a topic selected by the student.	Testing of the knowledge base is through: Assessed coursework (topics:1, 2, 3, 4); Examination (topics: 1, 2, 4);

Learning Outcomes for MSc Advanced Technologies in Electronics

B. Subject Specific Skills

Subject Specific Skills	Teaching/Learning Methods and Strategies	Assessment
Students will be able to: 1. Compare the performance characteristics of neural networks, fuzzy systems, evolutionary computation and reinforcement learning.UFE018QM 2. Design a communication protocol and implement it in a high-level language. CommNetprot 3. Utilise an interrupt structure in order to design an event driven embedded system using a mixture of high and low level programming language. Embedded RealTime Systems 4. Write a research proposal that includes aims, research questions, research method and expected outcomes. UFQ007QM. 5. Undertake critical analysis and design tasks in one of the following focused technical areas; • Advanced Electrical Engineering • Software-Hardware Co-Design	Throughout the programme, the skills listed are developed through a combination of theoretical discussion, practical laboratory-based work, classroom based tutorial exercises and directed self-study. The general teaching/learning method is to impart these practical skills by a process of moving from an overview of what is required to a specific application of an individual skill at a higher level. Specific skills are consolidated thorough practical work.	The possession of these skills is demonstrated both by the development of a practical piece of coursework (software) and by examination. The practical nature of many of the skills to be acquired means that particular modules specifically address the skills. The examination allows students to demonstrate that they have grasped the underlying concepts that inform the development of such an artifact.

Learning Outcomes for MSc Advanced Technologies in Electronics

C. Cognitive (Intellectual) Skills

Cognitive (Intellectual) Skills	Teaching/Learning Methods and Strategies	Assessment
1. Apply the principles covered in the award elsewhere 2. Critically evaluate developments in technology, particularly in telecommunications 3. Critically analyse theoretical perspectives relevant to the research process 4. Evaluate research methodologies, tools and techniques, and the process of research, reflectively.	All skills are supported to varying degrees by lectures. In addition, guidance on the use of the library and on-line resources will be given initially in induction, throughout the award, and specifically with regard to the research proposal and the dissertation Individual skills are also supported as follows: Skill 1 is particularly addressed in Intelligent and Adaptive Systems which uses case studies to demonstrate the applicability of principles to different domains. Skill 2 is exercised in Networks and Protocols where students are encouraged to develop protocols during practical sessions and to evaluate their success Research Methods focuses on the tools and techniques of 3, and their evaluation. The dissertation is the specific medium through which the appropriateness of these tools is considered in relation to a particular problem (4).	All skills are assessed by coursework. In addition, skill 3 is assessed by a presentation whilst skills 1,2 and 4 are assessed by examination.

Learning Outcomes for MSc Advanced Technologies in Electronics

D. Key (Transferable) Skills

Key (Transferable) Skills	*Teaching/Learning Methods*	*Assessment*
1. Communication skills**:** to communicate orally or in writing.	1. Skill one is developed through a variety of methods and strategies including the following: ♦ Students participate in discussion tutorials ♦ Students present research topic findings in tutorials ♦ Students participate in individual tutorials	All of the skills are demonstrated in varying degrees in all of the employed assessments with the exception of teamwork, which is covered in some of the coursework. It would be impossible to progress to completion on the half-award without demonstrating a basic competence in all of these skills.
2. Self-management skills: to manage one's own time; to meet deadlines; to work with others having gained insights into the problems of team-based software development.	2. Skill two is developed through a variety of methods and strategies including the following: ♦ Students conduct self-managed practical work ♦ Students participate in practically-oriented tutorial laboratory sessions ♦ Students work through practical work-sheets in teams ♦ Students practice design and programming	
3. IT skills in context: to use software tools in the context of application development.	3. Skill three is developed through a variety of methods and strategies including the following: ♦ Students conduct self-managed practical work ♦ Students participate in experimental investigation tutorials ♦ Students work through practical work-sheets in teams ♦ Students make use of online teaching materials	
4. Problem Formulation and Decision-Making: To undertake analysis and interpretation of information and express problems in appropriate notations.	4. Skill four is developed through a variety of methods and strategies including the following: ♦ Students develop problem solving programs ♦ Students practice design using a number of different notations	

5. Progression to independent learning: To gain experience of, and to develop skills in, learning independently of structured class work. For example, to develop the ability to use on-line facilities to further self-study.	5. Skill five is developed through a variety of methods and strategies including the following: ♦ Students are encouraged to research relevant topics ♦ Students are encouraged to use online facilities to discover information ♦ Students research and write a dissertation with 'light-touch' supervision.	
6. Awareness of professional literature: to read and to use literature sources appropriate to the discipline to support learning activities	6. Skill six is developed through a variety of methods and strategies including the following: ♦ Students are encouraged to access online material ♦ Students review the literature for discussion in tutorial classes ♦ Students write a dissertation	
7. Teamwork: to be able to work as a member of a team; to be aware of the benefits and problems which teamwork can bring	7. Skill seven is developed through a variety of methods and strategies including the following: ♦ Students are required to participate in tutorial discussions.	

Learning Outcomes for MSc Engineering & Technology Management

A. Knowledge and Understanding of:

Learning Outcomes	Teaching and Learning Strategy	Assessment
1. The way in which the effectiveness of an engineering organisation depends on a multiplicity of factors - technical, human and commercial and the skills and attitudes needed to manage these factors to achieve goals. 2. The strategy formulation and implementation in the context of domestic and international industrial perspectives including the advances in technology 3. Multiple approaches to operations management and improvement 4. Concepts and principles implicit in the financial management and accounting 5. Lean thinking methodologies for continuous improvement 6. Underlying concepts, trends and applications relevant to the technology domain explored in the chosen option modules.	In addition to providing insights into some of the latest technologies, the award encourages students to take an integrated view of a manufacturing enterprise by placing technology in strategic, financial, human and operational context. The first semester delivers the concepts, methods and tools for strategy formulation and financial & operational management. Alongside this, students are also given a deeper understanding of the concepts and practice of a current area of technology. Thus the students are encouraged to take an integrated view and place technology in strategic, financial, human and operational context. The second semester continues with the delivery of the concepts and practice of further two areas of cutting edge technology along with the tools and techniques for achieving efficiency and leanness in the implementation and management of the technology. In this semester students are also encouraged to think about the business of research and their dissertations in particular by the study of research methods. Throughout, students are encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden individual knowledge and understanding of the subject. All of these outcomes are supported by the use of traditional methods including lectures, tutorials and seminars. In addition specific outcomes are supported as follows: • By carrying out a supervised mini project and presenting a report • By lab based practical work relevant to the technology area covered in the option module choice. • By participating in case studies, ensuing classroom discussion and presentations • By carrying out assignments requiring independent research and self study and learning from the feedback provided by the tutors • By working with a number of software tools both in the management and technology based subjects	1, 2, and 6 are assessed by a combination of coursework and examination 4 is assessed by a group project , presentation and viva 5 & 6 are assessed by supervised mini projects

Learning Outcomes for MSc Engineering & Technology Management

B. Subject Specific Skills

Learning Outcomes	Teaching and Learning Strategy	Assessment
1. Critically evaluate the strategic and operational aspects of an organisation and propose changes required for improved competitiveness of the business 2. Carry out objective analysis of financial data for making managerial decisions, particularly in the context of technology implementation 3. Carry out a critical analysis of multiple approaches to operations management and improvement 4. Confidently propose and defend the implementation of Lean Thinking methodologies in his/her organisation 5. Carry out in an in-depth study of a substantial technical problem and to apply knowledge gained through the taught material and independent study 6. Use tools and techniques explored in the option modules to design a working solution to a problem in the light of company requirements	Concepts in different subjects are provided through the lectures and reinforcement of these concepts and their application to real life problems is carried out through tutorials, case studies, laboratory exercises, computer labs, assignments and supervised mini projects. Students are encouraged to undertake independent reading and research in different subjects, apply the results of the research to solve a given problem in a number of ways, critically evaluate different solutions, state the preferred solution and support this conclusion using acquired knowledge. Students' skills of criticality are developed throughout the duration of the award through class room discussions based on case studies, presentations by students of their work, supervised individual project, laboratory exercises, industrial visits and other such opportunities.	Learning outcomes 1 and 6 are assessed by course work, examination or mini project or a combination of the above. . Assessment of learning outcome 2 and 4 is carried out through a mini projects. Group project is used to assess 3 and dissertation is the assessment method for learning outcome 5.

Learning Outcomes for MSc Engineering & Technology Management

C. Cognitive Skills

Learning Outcomes	Teaching and Learning Strategy	Assessment
1. Ability to deal with complex issues both systematically and creatively. 2. Be able to make sound judgements in the absence of complete data. 3. Ability to communicate their conclusions clearly to specialist and non-specialist audiences. 4. Self-direction and originality in tackling and solving problems 5. Ability to act autonomously in planning and implementing tasks at a professional level. 6. Ability to carry out an in-depth analysis of a technical problem, explore solutions, make recommendations and put forward convincing arguments in their defence.	All skills are supported to varying degrees through lectures. The award encourages students to place the strategic and operational aspects of an engineering industry in the context of engineering and technology, finance and other internal and external factors. Thus the students learn to deal with complex issues whether they are learning about the strategic and operations management or are being given insights into some of the modern but complex technologies. In carrying out assignments and projects, often all the data required to solve problems is not available and students are encouraged to make judgements in solving problems and arriving at conclusions. Many modules require students to present their work to their peers as well to appear in a viva in the presence of a tutor. A broad marking scheme is given to the students at the time of setting assignments and projects. The students however, are encouraged to plan the contents of their assignments and project reports. The dissertation provides students the opportunity to engage in an in-depth problem requiring an in-depth analysis of a complex problem, make recommendations and forward convincing arguments in their defence.	Learning outcomes 1-5 are assessed by various degrees in all the modules. The learning outcome 6 is comprehensively assessed by the dissertation.

Learning Outcomes for MSc Engineering & Technology Management

D. Transferable Skills

Learning Outcomes	Teaching and Learning Strategy	Assessment
1. Communication Skills (to communicate orally or in writing, including for instance the results of technical investigations, to peers and/or to 'problem owners') 2. Self-management Skills (to manage one's own time; to meet deadlines; to work with others) 3. IT Skills in Context (to use software in the context of problem-solving investigations, and to interpret findings) 4. Problem Formulation and Decision-making (to express problems in abstract terms; to undertake analysis and interpretation in the context of the discipline; to interpret the results of findings in appropriate terms) 5. Progression to Independent Learning (to gain experience of and to develop skills in learning independently of structured classroom work) 6. Awareness of Professional Literature (to be aware of, and where appropriate to read and to use literature sources relevant to the discipline to support learning activities) 7. Working with Others (to be able to work as a member of a team; to be aware of the benefits and problems which teamwork can bring)	Transferable skills are developed throughout the award. The emphasis on group work and use of case studies as a platform for sharing and presenting information and ideas develops communication skills and ability to work with others. Transferable skills 1-6 are developed in most modules through presentations, written assignments and individual research. There are plenty of opportunities for students to use software tools for problem solving while carrying out assignments. Some modules in e.g. the Machine Vision and robotics themes also require students to develop software for carrying out certain tasks. The dissertation module provides an excellent opportunity to develop skills in independent learning, time management, exhaustive literature search, critically interpret the results of the findings, problem formulation, applying information and data to the solution of complex problems and defend own conclusions	Written assignments, group work and presentations assess skills 1, 2, 4, 5, 6, 7. Skill 3 is developed when using software tools both in the management and technology based subjects. The dissertation proposal and the dissertation itself assess all skills, particularly skills 2, 4, 6, 5.

Learning Outcomes for MSc Software Engineering

A Knowledge and Understanding

Learning Outcomes	Teaching, Learning and Strategies	Assessment
1. Theoretical perspectives that underpin Software Engineering and distinguish it from other disciplines 2. Software Engineering as a coherent process which provides a basis for organised software development 3. Project planning and control methods and aids 4. The common activities associated with requirements elicitation, analysis, specification, validation, and management 5. The concerns associated with the analysis, design and implementation of object-oriented software 6. The problems associated with development within a particular application domain. 7. The nature of the research process 8. How to carry out research in order to synthesise a computer-based system that meets given requirements	The general approach to teaching on this award is use the first semester to deliver theoretical concepts (SE Concepts/Project Management) and fundamental tools (Requirements Engineering/OO Design and Programming) and then to move to a more applied approach in semester 2. For example, in semester 2, the module Software Management and Development takes a holistic approach and allows the students the opportunity to pursue the whole software development lifecycle from requirements through to delivery. The option choices provide the opportunity of looking at a particular application domain and considering how software is engineered in that area. In semester 2, students are also encouraged to think about the business of research and their dissertations in particular by the study of Research Methods. Throughout, the learner is encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden individual knowledge and understanding of the subject. All of these outcomes are supported by the use of traditional methods, lectures and seminars. In addition specific outcomes are supported as follows: ▪ 1 by the use of in-class exercises and presentations by individuals on selected areas of systems development ▪ 2 by the pursuing a SE group project in which the tutor acts as a client and comments on progress. ▪ 3 and 4 by classroom based practical work ▪ 5 by lab based practical work. ▪ 6 by discussion and lab work related to the student's option choices. ▪ 7 and 8 by individual supervision.	1 is assessed by an individual presentation and coursework. 2 is assessed by coursework and an individual personal appraisal 3 – 5 are assessed by coursework and examination 6 is generally assessed by coursework. The nature of this coursework depends upon the chosen areas of interest. 7 is assessed by a research proposal. 8 is assessed by a dissertation and a computer based demonstration

Learning Outcomes for MSc Software Engineering
B Cognitive Skills

Learning Outcomes	Teaching Learning and Strategies	Assessment
1. To comprehend new concepts both for use in during the course and, later, professionally 2. Understand human roles and how various functions interact to successfully produce an artefact. 3. Recognize the role of the engineering approach in the production of an artefact – in particular a software system. 4. Formulate, analyse, visualise, synthesize and communicate designs to solve application software problems; 5. To explore, evaluate and use software development technology 6. Evaluate alternative approaches to problem solving within an application domain. 7. Critically analyse theoretical perspectives relevant to the research process 8. Evaluate research methodologies, tools and techniques, and the process of research, reflexively	All skills are supported to varying degrees by lectures. In addition, guidance on the use of the library and on-line resources will be given initially in induction, throughout the award, and specifically with regard to the research proposal and the dissertation Individual skills are also supported as follows: ▪ Software Engineering concepts explores different models of SE and encourages students to think more deeply and critically about these by requiring individual presentations which explore topics introduced in the lectures, thus ensuring the delivery of 1. ▪ Both Software Management and Development and Project management address 2 via lectures and class-based exercises. In particular, the role of management is considered together with the risks that might impede attainment of a successful product is examined in Project Management. ▪ 3 is considered in a number of modules (Software Engineering Concepts, Software Management and Requirements Engineering). In particular, Requirements Engineering uses case-studies as a means of exploring the engineering of software requirements. ▪ 4 is principally addressed in the context of OO Design and Programming by the use of in-class exercises ▪ 5 is considered in both Requirements Engineering and OO Design and Programming, in which students are encouraged to consider the use of CASE tools. . ▪ Learning outcome 6 is addressed within the student's option choices, generally by discussion and directed reading, though this varies depending upon the options chosen ▪ The focus of Research Methods is on the tools and techniques of 7, and their evaluation. The dissertation is the specific medium through which the appropriateness of these tools is considered in relation to a particular problem.	1 is assessed by a presentation. 2 is not formally assessed. 3 by coursework 4 by implementing a non-trivial software development exercise. 5 by group project and report. 6 is assessed by coursework. 7 , 8 are assessed by the research proposal and the production of a supervised dissertation.

Learning Outcomes for MSc Software Engineering

C Subject, Professional and Practical Skills

Learning Outcomes	Teaching Learning and Assessment Strategies	Assessment
1. Apply SE concepts to the construction of construction of large scale software (Software Engineering Concepts) 2. Assess project risk using taught methods (Project Management) 3. Use requirements engineering methods to develop software requirements specifications for software and computer-based systems (Requirements Engineering) 4. Effectively design and construct Java software solutions using a variety of tools (e.g. CASE tools, editors, compilers, debuggers, etc.) and/or Integrated Development Environments (IDE). (OO Design and Programming) 5. In depth knowledge of an OO programming language. (OO Design and Programming) 6. Implement a variety of software development strategies and techniques. (Software Management and Development) 7. Prepare a research proposal in the subject area 8. Use data collection techniques appropriate to the area being investigated.	All skills are developed through lectures and tutorials. For the most part, subject specific skills reside in individual modules. The list given is the minimum that a graduate of MSc Software Engineering could be expected to possess. Additional skills specific skills will be gained through the study of particular options and through the dissertation process, which requires the production and demonstration of a software artefact. ▪ 1 through group discussions and presentations in Software ▪ 2 through the staged solving of a demanding planning exercise ▪ 3 through directed reading and a practical exercise ▪ 4 and 5 through hands-on design and programming experience. ▪ 6 through in-class exercises and group work. ▪ 7 through group discussions and investigative reading. ▪ 8 through individual supervised research.	Outcomes 1 – 4 are all assessed by course work and exam. Learning outcome 5 is demonstrated by coursework and used as a tool within an exam. 6 is assessed by a combination of group work and formal personal reflection. 7 is assessed by a presentation and coursework; 8 by the dissertation.

Learning Outcomes for MSc Software Engineering

D Transferable skills and other attributes

Learning Outcomes	Teaching, Learning and Assessment Strategies	Assessment
1. Communication Skills 2. Self-management skills 3. IT skills in context 4. Problem formulation and decision-making skills 5. Progression to independent learning 6. Awareness of professional literature 7. Working with others:	Transferable skills are developed throughout the program. The emphasis on group work in some modules particularly ensures that 1 and 7 are met. Transferable skills 1- 6 are developed through the mix of presentations, written assignments and individual research Acquisition of 1 and 2 is through presentations and written assignments. Acquisition of 3 is through laboratory-based practical sessions. Acquisition of 4 , 5 and 6 is through individual investigative, problem-solving and research tasks.	Written assignments and presentations assess skills 1 – 4. The dissertation proposal and the dissertation itself assess all skills, but particularly skills 5 and 6. Group project work, especially in Software management and Development, assesses skill 7.

Learning Outcomes for MSc Computer Science

A. Knowledge and Understanding o:

Knowledge and Understanding of:	Teaching/Learning Methods and Strategies	Assessment
1. A number of advanced algorithmic topics such as string processing, path optimization, DNA algorithms and parallel algorithms in module Algorithms 2. The fundamental features of intelligent and adaptive systems in Intelligent and Adaptive Systems. 3. The components of Communication Networks and the protocols and algorithms used in their implementation. In Computer Networks and Protocols 4. The nature of the research process and the range of research methods available in Research Methods. 5. The concepts, methods and mechanisms associated with the chosen option modules.	On all modules the learner is encouraged to undertake independent reading both to supplement and consolidate what is being learnt and to broaden their individual knowledge of the subject. The programme of study is designed to further the knowledge and understanding necessary to engage, from the beginning, in appreciating and solving problems. For all students of MSc Computer Science, semester 1 of their studies introduces the context in which these issues reside by contrasting principles of algorithmic computation with those of intelligent systems and introducing important and fundamental ideas about communicating over networks. At the same time, students will develop their research formulation skills in preparation for later independent work. In semester 1, knowledge and understanding of topics 1-4 (algorithms, adaptive systems, networks and research methods) are introduced on four modules that explore the general concepts and issues, positioning them within a computer science framework.	Testing of the knowledge base is through: Assessed coursework (topics: 2, 3, 4); Examination (topics: 1, 2, 3); Assessment of 5 is dependent upon option choice.

Learning Outcomes for MSc Computer Science

B Subject Specific Skills

All graduates of MSc Computer Science will gain subject specific skills in the following areas:

Subject Specific Skills	**Teaching/Learning Methods and Strategies**	**Assessment**
Students will be able to: 1. Evaluate a variety of advanced algorithms for correctness and efficiency (in Algorithms) 2. Compare the performance characteristics of neural networks, fuzzy systems, evolutionary computation and reinforcement learning in Intelligent and Adaptive Systems 3. Design a communication protocol and implement it in a high-level language in Computer Networks and Protocols. 4. Write a research proposal that includes aims, research questions, research method and expected outcomes in Research Methods 5. Develop solutions to problems with the application domain(s) relevant to their option choices, using appropriate tools and techniques.	Throughout the program, the skills listed are developed through a combination of theoretical discussion, practical laboratory-based work, classroom based tutorial exercises and directed self-study. A number of the skills listed (1, 2, 3, 4) are introduced in semester 1 and then drawn into sharper focus in Semester 2 and in the dissertation. The general teaching/learning method is therefore to impart these practical skills by a process of moving from an overview of what is required to a specific application of an individual skill at a higher level.	The possession of these skills is demonstrated both by the development of a practical piece of coursework (software) and by examination. The practical nature of many of the skills to be acquired means that particular modules specifically address the skills.

Learning Outcomes for MSc Computer Science
C Cognitive (Intellectual) Skills

All graduates of MSc Computer Science will develop the following cognitive skills:

Cognitive (Intellectual) Skills	Teaching/Learning Methods and Strategies	Assessment
1. To study and apply appropriate analytical methods as required. 2. Apply the principles covered in the award elsewhere 3. Critically evaluate developments and new applications of systems. 4. Critically analyse theoretical perspectives relevant to the research process 5. Evaluate research methodologies, tools and techniques, and the process of research, reflexively 6. Analyse an application area to determine appropriate approaches to solving problems in that area.	All skills are supported to varying degrees by lectures. In addition, guidance on the use of the library and on-line resources will be given initially in induction, throughout the award, and specifically with regard to the research proposal and the dissertation Individual skills are also supported as follows: a. Skill 1 is consolidated by tutorial work in Algorithms b. Skill 2 is particularly addressed in Intelligent and Adaptive Systems which uses case studies to demonstrate the applicability of principles to different domains. c. Skill 3 is exercised in Networks and Protocols where students are encouraged to develop protocols during practical sessions and to evaluate their success. d. The focus of Research Methods is on the tools and techniques of 4, and their evaluation. The dissertation is the specific medium through which the appropriateness of these tools is considered in relation to a particular problem. e. Skill 6 is exercised throughout the programme and especially in semester 2 modules.	Skills are assessed by both coursework and examination

Learning Outcomes for MSc Computer Science

D. Transferable Skills

All students who graduate with an award of MSc Computer Science can be expected to have attained the skills shown in the table below.

Transferable Skills	**Teaching/Learning Methods**	**Assessment**
1. Communication skills**:** to communicate orally or in writing.	1. Skill one is developed through a variety of methods and strategies including the following: ♦ Students participate in discussion tutorials ♦ Students present research topic findings in tutorials ♦ Students participate in individual tutorials	All of the skills are demonstrated in varying degrees in all of the employed assessments with the exception of teamwork, which is covered in some of the coursework. It would be impossible to progress to completion on the award without demonstrating a basic competence in all of these skills.
2. Self-management skills: to manage one's own time; to meet deadlines; to work with others having gained insights into the problems of team-based software development.	2. Skill two is developed through a variety of methods and strategies including the following: ♦ Students conduct self-managed practical work ♦ Students participate in practically-oriented tutorial laboratory sessions ♦ Students work through practical work-sheets in teams ♦ Students practice design and programming	
3. IT skills in context: to use software tools in the context of application development.	3. Skill three is developed through a variety of methods and strategies including the following: ♦ Students conduct self-managed practical work ♦ Students participate in experimental investigation tutorials ♦ Students work through practical work-sheets in teams ♦ Students make use of online teaching materials ♦ Students are encouraged to practice programming to extend their skills	
4. Problem Formulation and Decision-Making: To undertake analysis and interpretation of information and express problems in appropriate notations.	4. Skill four is developed through a variety of methods and strategies including the following: ♦ Students develop problem solving programs ♦ Students practice design and programming in a number of different languages ♦ Students sketch designs of larger systems	

5. Progression to independent learning: To gain experience of, and to develop skills in, learning independently of structured class work. For example, to develop the ability to use on-line facilities to further self-study.	5. Skill five is developed through a variety of methods and strategies including the following: ♦ Students are encouraged to practice programming to extend their skills ♦ Students are encouraged to research relevant topics ♦ Students are encouraged to use online facilities to discover information ♦ Students complete a dissertation with 'light-touch' supervision	
6. Awareness of professional literature: to read and to use literature sources appropriate to the discipline to support learning activities	6. Skill six is developed through a variety of methods and strategies including the following: ♦ Students are encouraged to access online material ♦ Students review the literature for discussion in tutorial classes	
7. Teamwork: to be able to work as a member of a team; to be aware of the benefits and problems which teamwork can bring	7. Skill seven is developed through a variety of methods and strategies including the following: ♦ Students are required to participate in tutorial discussions ♦ Students will develop software in small groups	

Learning Outcomes for MSc Statistics & Management Science

A. Knowledge and Understanding

Learning Outcomes	Teaching and Learning Strategies	Assessment Strategy
1. The strengths and weaknesses of the management science approach to problem solving 2. The disciplines involved in problem definition 3. The differences between "real-life" and "modelled" solutions to problems 4. Exploratory data analysis techniques 5. The principles underlying statistical inference and the limitations in inferences due to the data collection process 6. The theoretical concepts behind elementary probability theory 7. The statistical theory relating to on-line process control and the reasons for the development of SPC 8. The benefits of designed experiments and the statistical models used in their analysis 9. Regression modelling and the General Linear Model 10. The uses, strengths, weaknesses and interpretation of a variety of multivariate techniques 11. A range of operational research techniques for addressing typical business problems. 12. The basic theory underlying the main exact and heuristic approaches to linear and combinatorial optimisation 13. Appropriate techniques for solving particular prediction problems and their strengths and limitations 14. The epistemological assumptions underpinning various research paradigms 15. The nature of the research process 16. The critical appraisal of their own and others' research processes and outcomes	Students will learn through a combination of formal lectures, tutorial classes, computer lab sessions, coursework assignments, prescribed reading and exercises. The strategic objectives of these methods are as follows: <u>Lectures</u> To develop theory and impart basic knowledge. <u>Tutorial classes</u> To discuss applications and exercises previously attempted by the student. <u>Reading</u> To extend knowledge and develop understanding. (The dissertation will be produced predominantly through independent study, supported by an academic supervisor). **Computer laboratory sessions** To gain insight into the practical challenges of applying the approaches taught. Some computer analysis of data using suitable packages (e.g. *Minitab*, *SPSS*, *Simul8*, *Excel*) will be done independently - not as scheduled teaching time. **Coursework assignments** To gain deeper experience and appreciation of the strength and weaknesses of statistical and management science techniques and to appreciate the challenges faced through their practical use.	Assessment of students' knowledge and understanding is through assessed coursework, the preparation of a research proposal, written and oral examinations. Additionally, informal assessment will be made through their presentation of group work during timetabled tutorial sessions. Assessed coursework (Topics 1 to 13) <u>The preparation of a research proposal</u> (Topics 14 to 16) Written examinations (Topics 1 to 13) Oral examinations (This applies to the dissertation module)

Learning Outcomes for MSc Statistics & Management Science

B. Subject Specific Skills

Learning Outcomes	Teaching and Learning Strategies	Assessment Strategy
1. Determine whether a relationship exists between two variables 2. Derive the expected value and variance for a variety of probability functions 3. Set up control charts and quantify the capability of a process 4. Use multiple regression techniques to build appropriate models and assess the resulting model diagnostics 5. Apply standard analysis of variance techniques to single factor and two factor situations 6. Use the General Linear Model to analyse data from a designed experiment and from an observational study 7. Analyse survival data using a variety of techniques 8. Develop some inferential procedures using bootstrap techniques 9. Formulate and solve problems using multivariate techniques 10. Use a range of time series and data mining methods to make forecasts and predictions from a data set 11. Select, use and interpret the outputs from a range of management science techniques 12. Apply appropriate research methods in order to produce a research proposal	Throughout the award, skills are developed through: ▪ Practical work in the classroom and computer laboratory ▪ Directed self-study ▪ Independent study The teaching/learning strategy typically imparts these skills by moving from general topic overviews to specific, often complex, problems. The overall objective is to develop the students' ability to produce work of good quality working autonomously in a professional environment.	These skills are assessed predominantly through written coursework and by written examination. Additionally, the dissertation module assesses a research proposal developed by the student and, subsequently, through an oral examination.

Learning Outcomes for MSc Statistics & Management Science

C. Cognitive Skills

Learning Outcomes	***Teaching and Learning Strategies***	***Assessment Strategy***
1. Critically evaluate the choice of statistical tests for given situations 2. Discuss issues surrounding validity and reliability of statistical models and their predicted values 3. Discuss the results of an analysis of variance with appropriate follow-up analyses 4. Design and defend procedures for bootstrap hypothesis tests 5. Critically appraise the strengths and weaknesses of a range of management science techniques 6. Evaluate the results of statistical and management science analyses and interpret them in cogent non-technical language 7. Formulate research questions 8. Appraise the utility of quantitative and qualitative research methods and their capacity to address the research question(s) formulated 9. Think and reflect in a critical and original manner 10. Independently learn new approaches as knowledge advances	Throughout the award, students develop these skills through attempting often complex and demanding work. At all times constructive feedback is provided to the students. Particular emphasis is paid to developing the students' confidence in autonomously applying the full range of knowledge gained.	These skills are assessed predominantly through written coursework and by written examination. Additionally, the dissertation module assesses a research proposal developed by the student and, subsequently, through an oral examination.

Learning Outcomes for MSc Statistics & Management Science

D. Key (Transferable) Skills

Learning Outcomes	Teaching and Learning Strategies	Assessment Strategy
Communication Skills (To communicate orally or in writing, including for instance the results of technical investigations, to peers and/or to 'problem owners')	This skill is developed predominantly through students' participation in group work sessions and tutorials where they present and discuss the results of their work.	The skills are assessed predominantly through the production of specified coursework and through written examinations. Additionally, the dissertation is assessed through an oral examination.
Self-management Skills (To manage one's own time; to meet deadlines; to work with others)	Students conduct self-managed directed work, both independently and in practically-oriented tutorial laboratory sessions. All coursework, and the dissertation, has to be completed to a high standard to specified timescales and deadlines.	
IT Skills in Context (To use software in the context of problem-solving investigations, and to interpret findings)	The award makes extensive use of computer software as an aid to problem solving. Students are taught the specific skills required for each package as an integral part of the relevant lectures.	
Problem Formulation and Decision-making (To express problems in abstract terms; to undertake analysis and interpretation in the context of the discipline; to interpret the results of findings in appropriate terms)	Statistics and management science are topics that require problem formulation, analysis and interpretation throughout. The award places great emphasis on a disciplined approach to these issues. Throughout, students are encouraged to present their results cogently using, wherever possible, non-technical language.	
Progression to Independent Learning (To gain experience of and to develop skills in learning independently of structured classroom work)	Students are encouraged to study independently, in both directed and non-directed forms. Specifically, the Research Methods module concentrates on the development of these skills.	
Awareness of Professional Literature (To be aware of, and where appropriate to read and to use literature sources relevant to the discipline to support learning activities)	Each module on the award specifies indicative reading material, with which the students are encouraged to become familiar. The dissertation module requires all students to study the published literature concerning their particular dissertation topic.	
Working with Others (to be able to work as a member of a team; to be aware of the benefits and problems which teamwork can bring)	The ability to work in a team is an important one for employment in this field. Modules include tasks which are carried out in groups.	

Learning Outcomes for MSc Information Technology

A Knowledge and Understanding

Learning Outcomes	Teaching and Learning Strategies	Assessment Strategy
A. All graduates of the MSc IT should gain knowledge and understanding of: 1. Computer systems architectures and electronic communication systems architectures 2. A high-level, object-orientated programming language 3. The nature of information, the range of application domains and trends in the application of IT 4. Contrasting approaches to systems development 5. Definitions of software engineering, and important software engineering concepts and themes 6. Technical and management approaches for producing effective IS solutions 7. Phenomenological and positivistic approaches to research 8. The practice of research and academic writing. 9. Concepts, issues and trends relevant to the application domains explored in the chosen option modules.	Throughout the learner is encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden individual knowledge and understanding of the subject. All of these outcomes are supported by the use of traditional methods, lectures and seminars. In addition specific outcomes are supported as follows: ▪ 1 and 2 by laboratory-based practical sessions. ▪ 3 by seminars where students report on areas of interest that they have investigated. ▪ 4 and 5 by the use of in-class exercises and presentations by individuals on selected areas of systems development. ▪ 6 by case study and group work facilitated by surgeries. ▪ 7 and 8 by individual supervision. ▪ 9 by a mix of group work, lab-based sessions, on-line learning and case studies, dependent on option choices	1 – 3 are assessed by examination and coursework. 4 and 5 are assessed by an examination, requiring students to write on a prepared topic with reference to wider systems development issues. 6 is assessed by a group portfolio of case study reports and an individual presentation. 7 and 8 are assessed by a research proposal, including a consideration of a range of approaches, and the dissertation. The assessment of 9 is dependent on option choices.

Learning Outcomes for MSc Information Technology

B. Intellectual Skills

***Learning* Outcomes**	***Teaching and Learning Strategies***	***Assessment Strategy***
All graduates of the MSc IT should be able to: 1. Critically evaluate developments and new applications of computer and communication systems 2. Evaluate the roles and uses of IT in different settings 3. Analyse and model systems problems 4. Evaluate a variety of methods and approaches to systems development: 5. Analyse case material to identify key features, and identify similarities and differences between a range of problems 6. Recognize a clear research question or hypothesis 7. Critically analyse theoretical perspectives relevant to the research process 8. Evaluate research methodologies, tools and techniques, and the process of research, reflectively 9. Relate theory and practice in the context of the application domains explored in the chosen option modules.	All skills are supported to varying degrees by lectures. Individual skills are also supported as follows: ▪ 1 by tutorials offering deeper and wider discussion of topics introduced in the lectures. ▪ 2 by seminars where students report on areas of interest that they have investigated. ▪ 3 and 4 by group work, in-class exercises, individual research and presentations. ▪ 5 by case study and group work, facilitated by surgeries. ▪ 6,7, and 8 by individual supervision. ▪ 9 by a mix of group work, on-line learning, case study work and lab-based sessions, dependent on chosen option modules. Guidance on the use of the library and on-line resources will be given initially in induction, throughout the award, and specifically with regard to the research proposal and the dissertation.	1 is assessed by examination. 2 is assessed by examination and an individual essay/report. 3 and 4 are assessed by examination requiring students to write on a prepared topic with reference to wider systems development issues. 5 is assessed by a group portfolio of case study reports and an individual presentation. 6 , 7 and 8 are assessed by the research proposal and dissertation. The assessment of 9 is dependent on option choices

Learning Outcomes for MSc Information Technology

C Subject, Professional and Practical Skills

Learning Outcomes	Teaching and Learning Strategies	Assessment Strategy
All graduates of the MSc IT should be able to: 1. Design small/medium sized programs to a given specification and implement these programs in a high-level language 2. Discern and appraise information flow in organizations and relate this to technological options 3. To apply systems development techniques in a variety of contexts 4. Integrate and apply knowledge of technologies, methods and application domains 5. Prepare a research proposal in the subject area **6.** Use data collection techniques appropriate to the area being investigated. **7.** Identify, evaluate and explain the impact of IT with respect to the application domain explored in the chosen option modules.	All skills are developed through lectures and tutorials . In addition to this skills are developed as follows: ▪ 1 through hands-on programming experience. ▪ 2 through group discussions. ▪ 3 through in-class exercises and group work. ▪ 4 through independent collaborative learning supported by surgeries ▪ 5 and 6 through individual supervised research. ▪ 7 by a mix of group work, on-line learning, case study work and lab-based sessions dependent on option module choice.	1 is assessed by coursework. 2 is assessed by examination and an essay/report. 3 is assessed by examination of a prepared topic. 4 is assessed by a group portfolio of case study reports and an individual presentation. 5 and 6 area assessed by the research proposal and the dissertation. The assessment of 7 is dependent on option choices

Learning Outcomes for MSc Information Technology

D. Transferable Skills

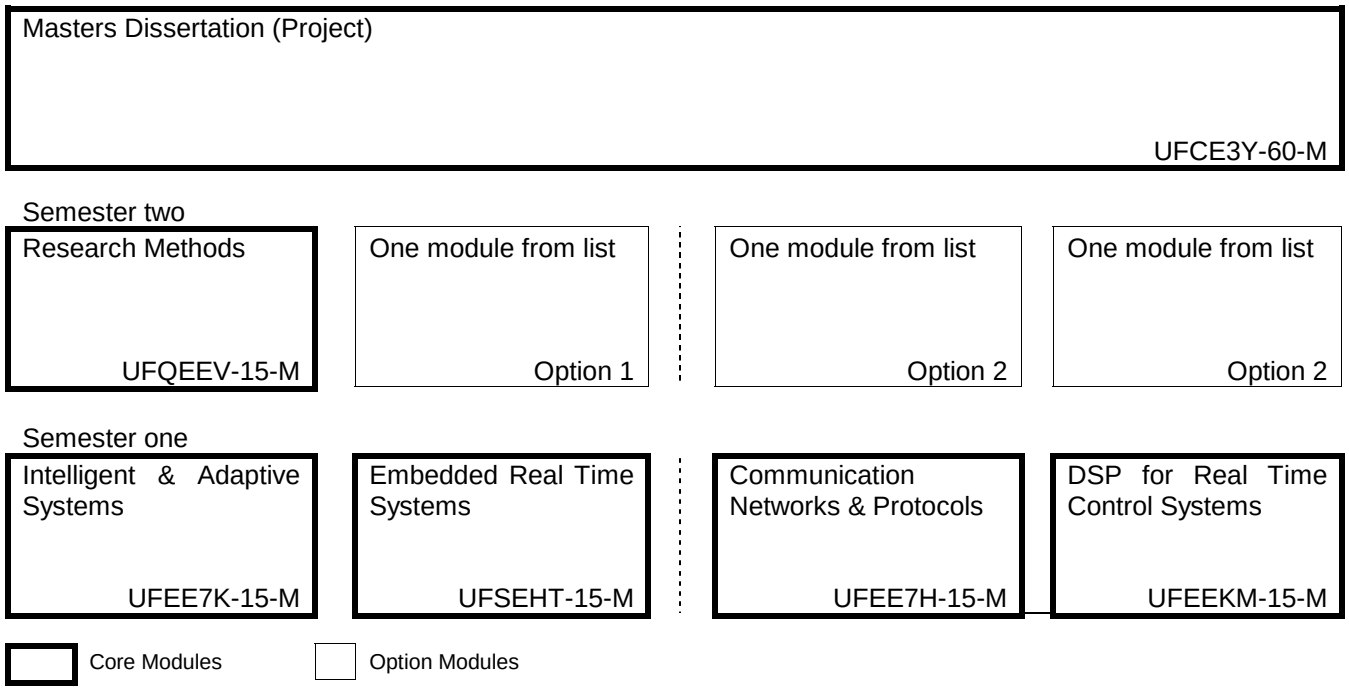
Learning Outcomes	Teaching and Learning Strategies	Assessment Strategy
All graduates of the MSc IT should be able to demonstrate the following transferable skills 1. Communication Skills 2. Self-management skills 3. IT skills in context 4. Problem formulation and decision-making skills 5. Progression to independent learning 6. Awareness of professional literature 7. Working with others	Transferable skills 1- 6 are developed through the mix of presentations, written assignments and individual research. More specifically group work (skill 7) is used throughout the award, but particularly in the core module Integrative Case Studies. Acquisition of 1 and 2 is through presentations and written assignments. Acquisition of 3 is through laboratory-based practical sessions. Acquisition of 4 , 5 and 6 is through individual investigative, problem-solving and research tasks.	*Written assignments and presentations assess skills 1 – 4. The dissertation proposal and the dissertation itself assess all skills, but particularly skills 5 and 6. Group project work assesses skill 7.*

PLEASE NOTE: REFER TO THE FACULTY ON-LINE INFORMATION SYSTEM FOR UP-TO-DATE STRUCTURE INFORMATION

http://www.cems.uwe.ac.uk/exist/index.xql

Programme Structure for **MSc Advanced Technology in Electronics** **For October 2004**

This structure is indicative and subject to change



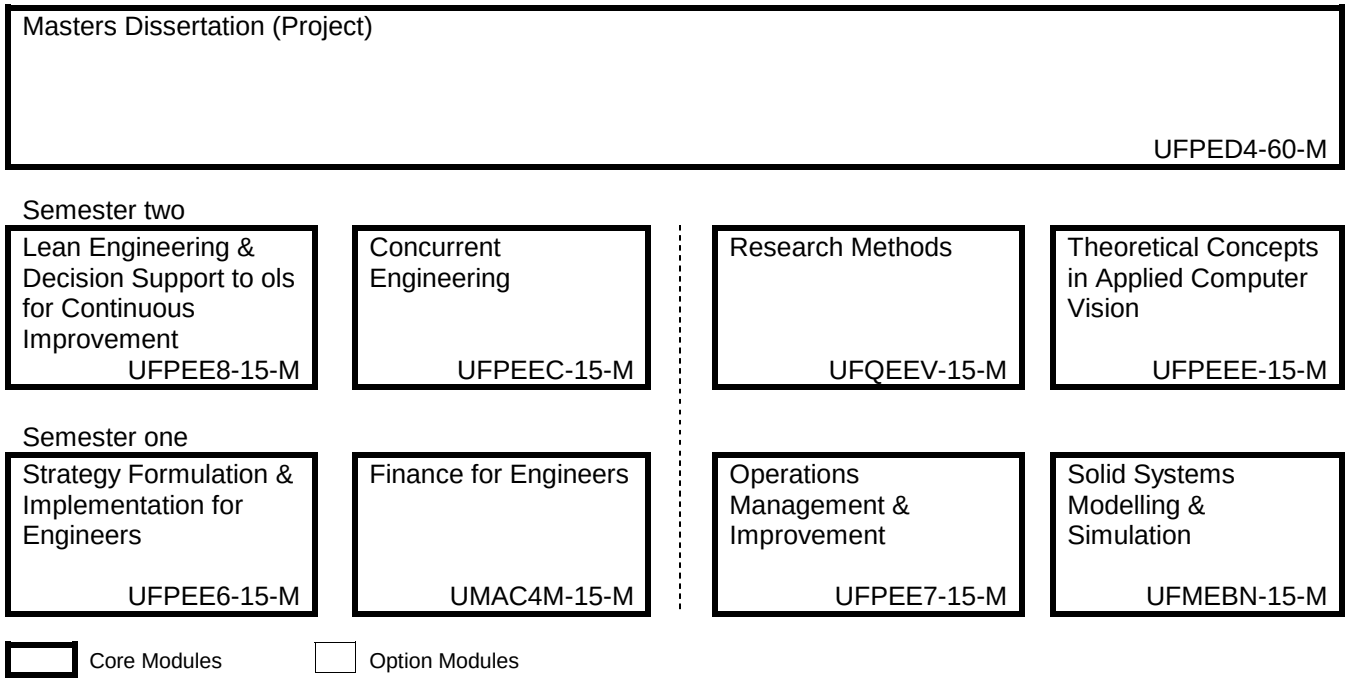
Part-time students in year one take modules to the left of the dotted line and in year two to the right of the dotted line

Option 1 taken from			
UFCE3N-15-M	Learning Classifier Systems	UFEE7M-15-M	Modern Power Systems
UFEE7P-15-M	Systems on Silicon	UMAC33-20-1	Understanding Financial Information

Option 2 taken from			
UFEE7F-15-M	Advanced Control & Dynamics	UFEE7G-15-M	Behavioural System Design
UFEE7L-15-M	Mobile Communications	UFEE7N-15-M	Neural Networks & Fuzzy Systems
UFPEE5-15-M	Actuators & Control		

Programme Structure for **MSc Engineering and Technology Management** **For October 2004**

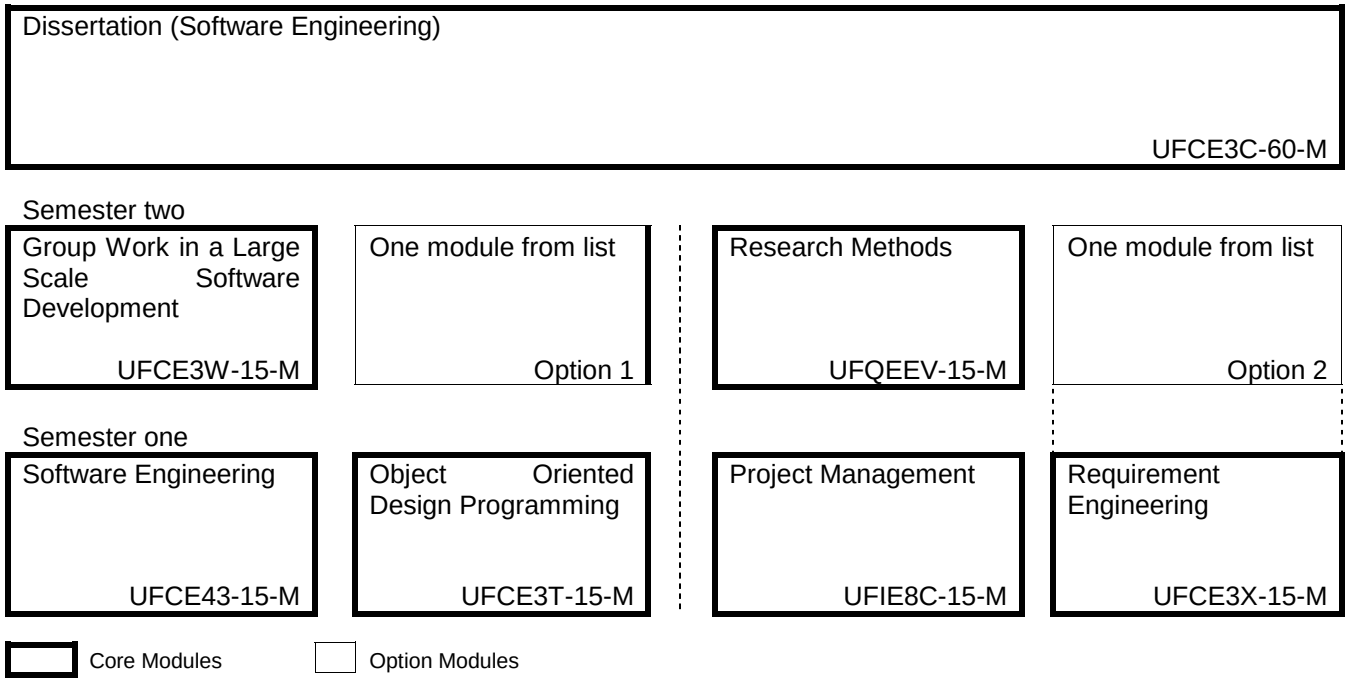
This structure is indicative and subject to change



Part-time students in year one take modules to the left of the dotted line and in year two to the right of the dotted line

Programme Structure for **MSc Software Engineering** **For October 2004**

This structure is indicative and subject to change



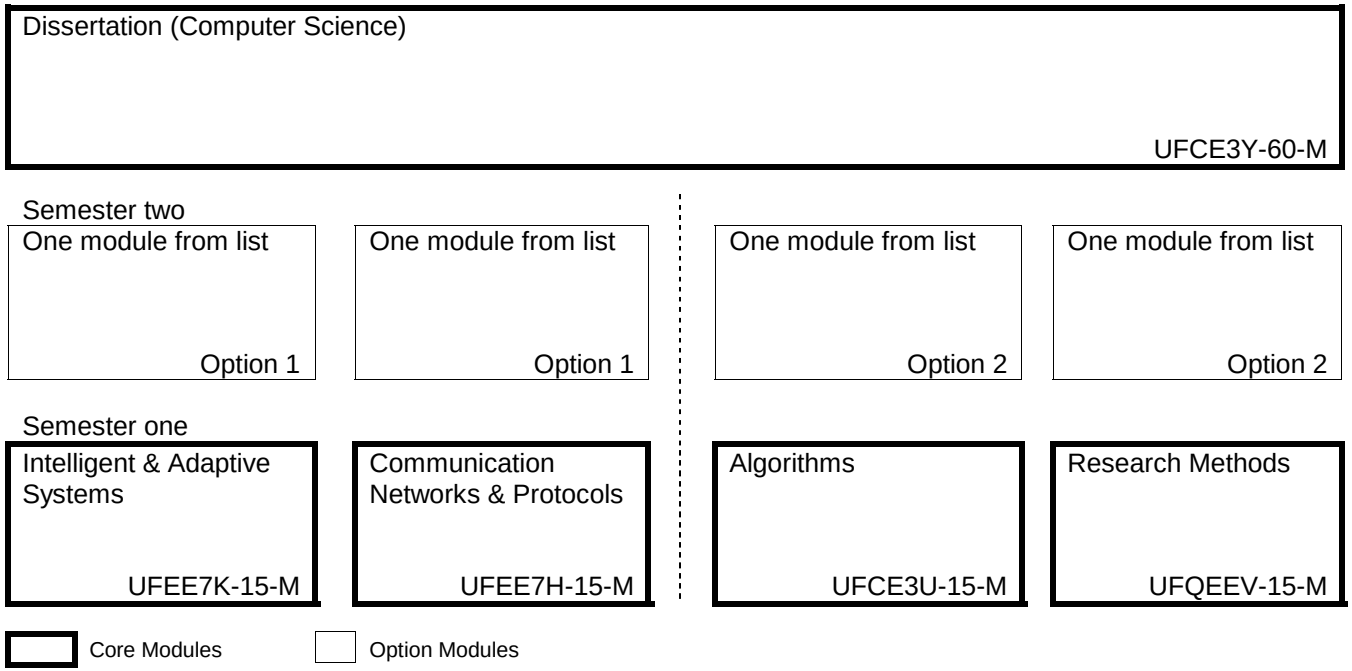
Part-time students in year one take modules to the left of the dotted line and in year two to the right of the dotted line

Option 1 taken from			
UFCE3R-15-M	Object Modelling & Design Patterns	UFIE8G-15-M	IS Development: Methods & Context
UFSEHR-15-M	Distributed Systems		

Option 2 taken from			
UFCE3Q-15-M	Advanced Databases	UFCE3S-15-M	Component Based Software
UFSEHS-15-M	Real Time Systems Development		

Programme Structure for **MSc Computer Science** **For October 2004**

This structure is indicative and subject to change



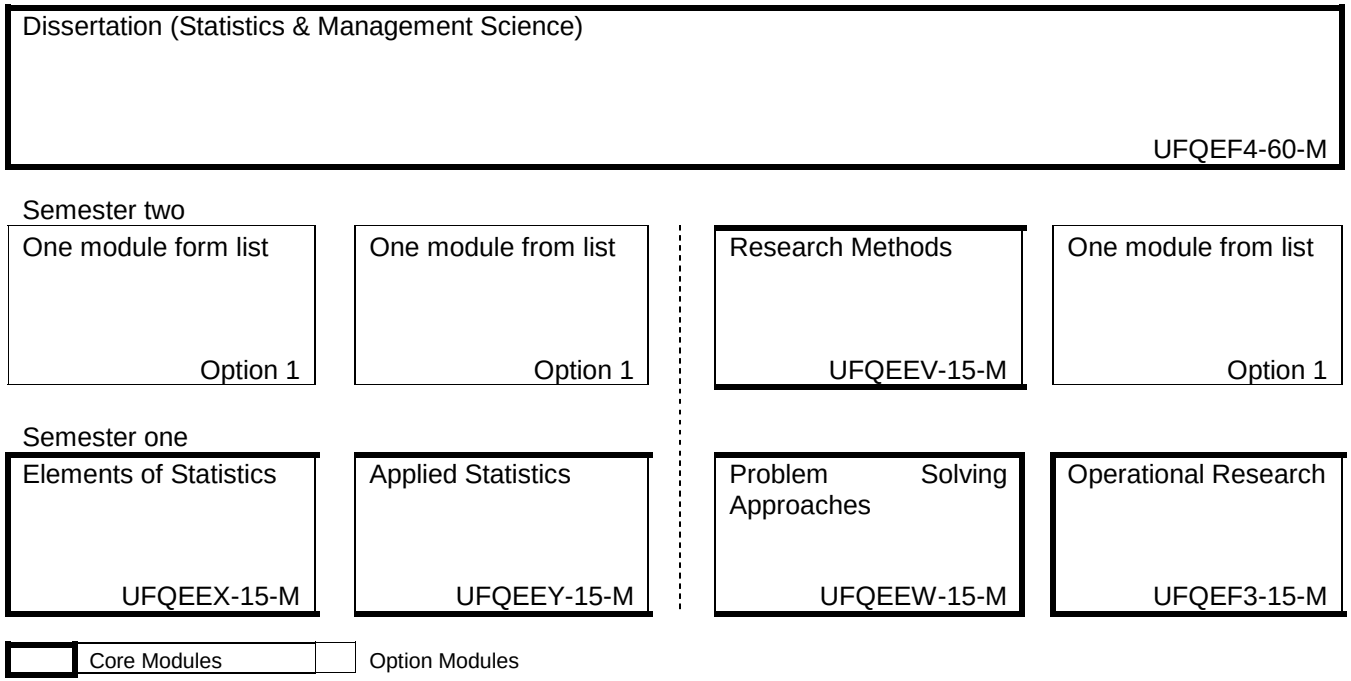
Part-time students in year one take modules to the left of the dotted line and in year two to the right of the dotted line

Option 1 taken from			
UFCE3N-15-M	Learning Classifier Systems	UFCE3R-15-M	Object Modelling & Design Patterns
UFCE3V-15-M	Inductive Learning	UFSEHR-15-M	Distributed Systems

Option 2 taken from			
UFCE3P-15-M	Evolutionary Computation	UFCE3Q-15-M	Advanced Databases
UFCE3S-15-M	Component Based Software	UFEE7N-15-M	Neural Networks & Fuzzy Systems

Programme Structure for **MSc Statistics and Management Science** **For October 2004**

This structure is indicative and subject to change

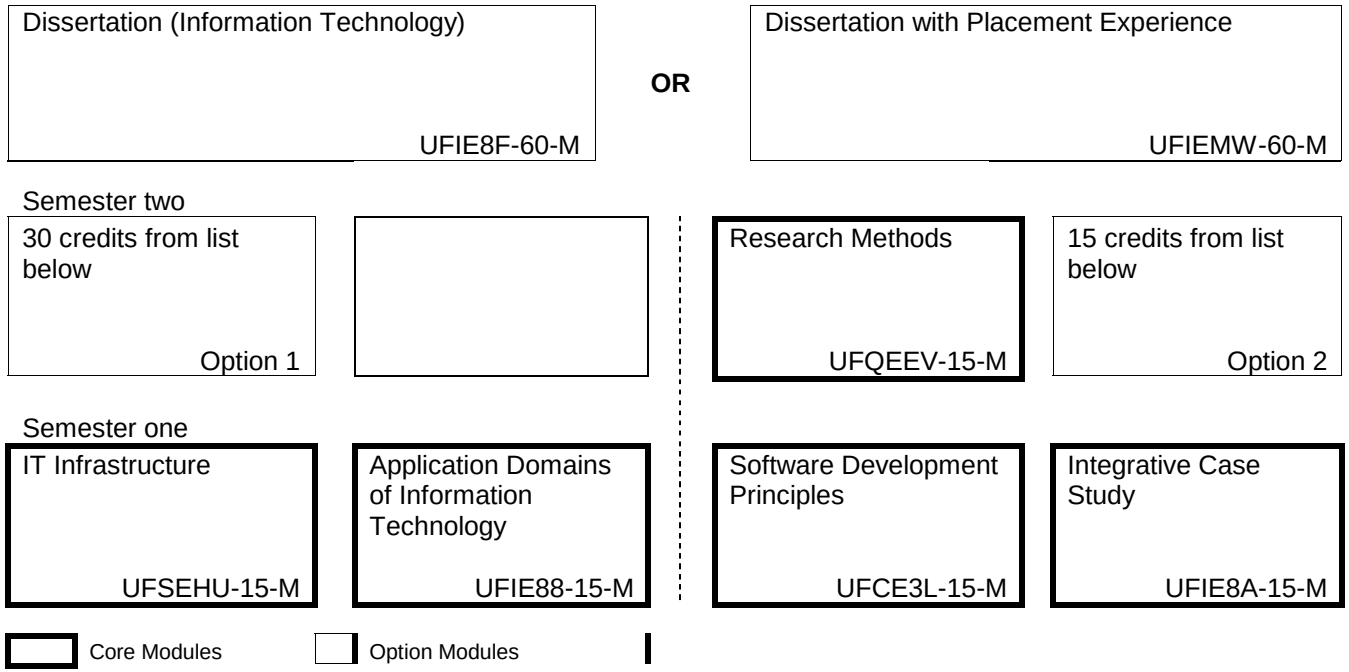


Part-time students in year one take modules to the left of the dotted line and in year two to the right of the dotted line

Option 1 taken from			
******3	BABDA students cannot take UFQEGQ-20-3	UFQEF5-15-M	Statistical Models
		UFQEF6-15-M	Applied Multivariate Techniques
UFQEF7-15-M	Prediction: Forecasting and Data Mining	UFQEF8-15-M	Combinatorial Optimisation and Heuristics
UFQEGQ-20-3	Decision Analysis		

Programme Structure for **MSc Information Technology** **For October 2004**

This structure is indicative and subject to change



Part-time students in year one take modules to the left of the dotted line and in year two to the right of the dotted line

Option 1 taken from			
UFCE3M-15-M	Group Work in a Large Scale Software Development Process	UFIE87-15-M	Information Systems Strategy & Management
		UFIE8B-15-M	Web Based Information Systems
UFIE8H-15-M	eBusiness	UFPEE4-15-M	Quality Assurance & Management
UFPEEH-15-M	Total Quality Management	UFPEMP-15-M	Academic & Professional Perspectives on Technology

Option 2 taken from			
UFCE44-15-M	Program Development	UFIE8C-15-M	Project Management
UFIE8E-15-M	Information Design	UFIE8J-15-M	Human Computer Interaction
UFIE8K-15-M	Data Management		

5. Entry Requirements

The normal requirement for entry to any of the programmes is an honours degree or equivalent. Award-specific entry requirements are as follows.

MSc Advanced Technologies in Electronics	An honours degree or equivalent in any branch of engineering, mathematics, computer science or the physical sciences.
MSc Computer Science	An honours degree or equivalent in computer science or a related discipline.
MSc Engineering & Technology Management	An honours degree or equivalent in mechanical, manufacturing or aerospace engineering, or a related discipline.
MSc Information Technology	There are no award-specific entry requirements.
MSc Software Engineering	An honours degree or equivalent in software engineering or a related discipline.
MSc Statistics & Management Science	An honours degree or equivalent in a scientific or quantitative discipline.

6. Assessment Regulations

The university's Modular Assessment Regulations apply to all programmes.

7. Student Learning

The learning outcomes of the scheme are varied and as a result need to be supported by a diversity of teaching, learning and assessment (TLA) methods. Consequently, the TLA strategy of the scheme is to offer a variety of experiences through lectures, tutorials, seminars, practicals, laboratory classes, case studies, projects, group activities, and other means. This variety serves to meet the aims of the provision in a number of ways:

- it reinforces the learning of knowledge, understanding, analytical abilities and skills by developing them in a wide variety of ways.
- it assists postgraduate students to enter into and sustain life-long learning by introducing them to styles of scholarship, including autonomous and independent study, which are likely to be required in their professional and intellectual future.

The scheme as a whole comprises the following methods of teaching, learning and assessment.

7.1. Teaching

Teaching takes place either in a group setting (classroom or a laboratory) or on an individual basis, involving:

- Lectures
- Flexible classroom session for tutorials, seminars, discussion of case-studies and group activities
- Practical or lab sessions held in a dedicated laboratory
- Research guidance during dissertation supervision.

The above teaching methods, integrated with learning and assessment, all contribute in varying degrees to the learning outcomes of the scheme.

7.2. Learning

Since almost all of the modules are level M, students will be expected to show maturity and initiative in relation to the management of their learning. Such learning also develops the student's intellectual skills of problem management and critical thinking, both of which emphasise learning in an autonomous manner.

Learning takes place not only through tutor-guided module learning activities in lectures, tutorials, seminars, discussion of case studies and group activities, but also

- for part-time students, in a professional environment via reflection within the workplace;
- through assessment, as indicated below.
- through self-managed private study related to modules (reading indicative literature on tutor's direction, researching via papers and electronic media on own initiative), and in particular through use of the university's Virtual Learning Environment ("Blackboard") which has been piloted in the faculty during 2002-03 and which the faculty expects to be increasingly used as a means of disseminating learning materials and other information and documentation.
- through private study as part of supervised dissertation research

7.3. Assessment

The assessment of a module supports and assures its learning outcomes. The choice of appropriate types and weightings of assessment in a module is an academic decision made by the module developer and its Field Leader. However the faculty expects that students experience an appropriate range of modes of assessment, in support of the TLA strategy of offering a variety of learning experiences, as discussed above. Depending on the type of module, elements of assessment within level M modules in the Faculty may include some or all of the following:

- tutor-marked *unseen* examinations taken under controlled conditions.
- tutor-marked *open book* examinations taken under controlled conditions.
- time-constrained tutor-marked examinations for which the question papers are *issued in advance*.
- time-constrained tutor-marked *practical laboratory* examinations.
- *on-line computer-based* assessment not under controlled conditions.
- tutor-marked *individual* or *group* coursework including presentations, exhibitions, case studies, problem-solving exercises, design tasks, and other experiences.
- leading or contributing to seminar discussion, based on previous study.

8. Reference Points and Benchmarks

A variety of reference points, both internal and external, have been of use in the planning and design of this scheme. The chief ones are as follows.

1. The faculty's previous experience of offering postgraduate schemes over a number of years
2. The QAA "Framework for Higher Educational Qualifications"
3. The QAA Subject Benchmark Statements particularly for Computing, for Engineering and for Mathematics, Statistics & Operational Research

4. The requirements, insofar as they are known, of professional bodies in computing, engineering and the mathematical sciences
5. The faculty's mission statement
6. The faculty's policies regarding teaching, learning & assessment and regarding transferable skills
7. Staff research and consultancy

The contribution of each of these to the design of the scheme is considered in turn.

8.1. Building on Previous Postgraduate Schemes

The creation of the Faculty of Computing, Engineering and Mathematical Sciences in 2001 led to the need to create a unified postgraduate scheme for the new faculty. An exercise which was conceived originally as a “tidying-up” exercise has instead resulted in something of a transmogrification of the schemes offered previously in the Faculties of Engineering and of Computer Studies & Mathematics. Nevertheless, the proposals have naturally been strongly influenced by the experience of running the existing Masters scheme.

The titles of the Masters awards which have been offered until now and which will be replaced by the awards in this proposal are as follows:

Existing Award Titles	**Place within new schemes**
Information Technology Manufacturing Info Systems Information Systems	To continue as pathways within the **MSc Information Technology**, with a common core of 75 credits and options thereafter for each route.
Total Technology Analytical Modelling for Engineering Design Mechatronics Technology Management	To continue as pathways within the **MSc Engineering & Technology Management**, with a common first semester and options thereafter.
Machine Learning & Adaptive Computing Intelligent Engineering Systems	To continue as pathways within the **MSc Computer Science**, with a common first semester and options thereafter.
Advanced Technologies in Electronics	To continue under this title
Software Engineering Systems Engineering & Project Management	To be combined into the new **MSc Software Engineering**.
Statistics & Management Science	To continue under this title
Total Quality Management AVGMVR	No longer to be offered.

The faculty has taken the opportunity of the need to create a unified postgraduate scheme to revise the portfolio of postgraduate awards by removing some award titles which had not proved attractive to students, by merging two or more titles under a single "umbrella title" in some cases, and by creating some new titles where a market opportunity was perceived. Thus, for instance,

existing award titles in "Information Technology", "Information Systems" and "Manufacturing and Management Information Systems" have been combined into a single MSc Information Technology which contains a number of pathways allowing specialisms in areas including information systems and manufacturing;
existing awards in "Total Technology", "Technology Management" and "Analytical Modelling for Engineering Design" have been combined into a single MSc Engineering & Technology Management, again with specialised pathways and modules available;
a new MSc Computer Science has been created to attract a more general market than was possible through the previously available titles in computing, which were somewhat specialist in nature; the new title is expected to be particularly attractive to the overseas

market.

The faculty has also adopted a uniform approach to the design and structure of its postgraduate scheme, with the following features applying to all awards:
a single set of educational aims, and a uniform framework for learning outcomes and teaching and learning strategy: we regard this as important in order to develop an approach to postgraduate teaching which will be widely accepted across the faculty;
the use of 15-credit modules, facilitating the design of any future pathways from existing modules and enabling clearly structured part-time pathways to be offered based on two years of study;
the inclusion in each award of a "Research Methods" module which prepares the student for the dissertation module.

Within this common framework there remains a considerable diversity of approaches to award design and module delivery, as is demanded by the wide range of disciplines encompassed.

We have also taken the opportunity to expand the range of award titles available in disciplines where we believe that there are likely to be interest from potential students. Thus, we have included a number of pathways within the MSc Computer Science, based on our experience of offering the MSc Machine Learning & Adaptive Computing, a title which has been discontinued. We have also developed new pathways for the MSc Information Technology, particularly the “Learning Society” route, which has been developed in collaboration with the Faculty of Education., and which is intended primarily for professionals in the field of education to develop awareness of the complex impact of IT on education.

8.2. The QAA Framework for Higher Educational Qualifications

The faculty supports the definition of Masters level contained in the framework in terms of the levels of understanding and of cognitive and other skills required of students. We believe that the educational aims and the framework for learning outcomes of these programmes, as outlined earlier in this document, are consistent with the framework.

The expectation of the Agency that postgraduate qualifications should be postgraduate in level and not merely in time has led the faculty to give careful consideration to developing its understanding of the "Level M-ness" of its postgraduate programmes. In doing so, we have been mindful of the need to design programmes which are appropriate for students who wish to pursue a specialist discipline in depth as well as for students who wish to develop skills and knowledge suitable for a broad range of applications contexts.

Our approach is accordingly one in which different programmes place differing degrees of emphasis on the various educational aims and learning outcomes in the faculty's framework. For instance, graduates from the MSc Statistics & Management Science or the MSc Information Technology are less likely than are those from the MSc Software Engineering or the MSc Advanced Technologies in Electronics to be able to pursue research at doctoral level in their discipline. Conversely, the former graduates may be better prepared than the latter for further professional (as opposed to academic) development, and in some of the skills which will enable them to make an immediate contribution in employment. In all cases, however, we expect "Level M-ness" to be expressed additionally through the student's approach to learning, and specifically through the pace and the degree of autonomy in learning.

8.3. QAA Subject Benchmark Statements

The QAA benchmarks are useful statements of the levels of achievement expected of honours graduates and therefore of potential entrants to Masters Schemes. We have designed our Masters programmes to build upon these, in terms of content as well as in terms of skill levels.

The benchmarks which relate particularly to our disciplines are those for Computing, for Engineering and for Mathematics, Statistics & Operational Research. In each case the benchmarks include the expectation that undergraduate curricula should include a range of skills including skill in communication, in teamwork and in managing one's own learning. We have accordingly assumed that entrants to our postgraduate programmes should possess these skills, and have planned the design of and delivery of our programmes accordingly.

8.4. Professional Body Requirements

The faculty gives regular consideration to the issue of whether to seek accreditation for its awards from the several professional bodies which cover the faculty's disciplines. None of these bodies confer a 'licence to practice', and for none of them is it the norm that practitioners in the field are members. This being the case, the faculty's view is that the costs involved in seeking accreditation are justified only if it is likely to result in increased numbers of applicants for the scheme.

The MSc Information Technology and the MSc Machine Learning and Adaptive Computing are the only postgraduate awards in the faculty which at present have accreditation by a professional body, in this case the British Computer Society. However there is little evidence that the accredited status of the MSc IT is of interest to the majority of applicants, and it is therefore unlikely that we will seek re-accreditation. Instead we anticipate that the MSc Computer Science and the MSc Software Engineering will be presented to the BCS at the accreditation visit due to take place in November 2003, and we would be confident of a successful outcome.

8.5. The Faculty's Mission Statement

Like many organisational mission statements, the mission of the Faculty of Computing, Engineering and Mathematical Sciences includes a number of aspirations whose omission might be regarded as more remarkable than their presence. So, we do aim, for instance, "*to demonstrate excellence in research linked to excellence in teaching*", and to provide "*opportunities for students of all ages and background to develop their full potential through courses of study educational experiences that are challenging and stimulating*", and we naturally regard the Masters scheme as being in fulfilment of these goals.

More distinctively, we aim to "*redefine subject boundaries and create new holistic and multidisciplinary approaches*", and we view our new Masters programmes as making a significant contribution towards this aim. Interdisciplinarity is a feature of many of the programmes. For instance:
the MSc Information Technology (Business Information Systems) enables students to bring an understanding of new technology to analyses of the effect of technological development on human and organisational systems;
the MSc Information Technology (The Learning Society) enables practitioners in the field of education to study how new technology can assist in the learning process;
the MSc Engineering and Technology Management brings a novel perspective to the study of engineering by explicitly connecting it to the study of the managerial and financial systems

which are required to achieve complex engineering goals;
the MSc Statistics & Management Science, which is now the only Masters programme in statistics in the south-west region, develops an understanding of statistical and operational research methods in the context of the business environment.

8.6. The Faculty's Teaching, Learning & Assessment Strategy

The aims of the faculty's TL&A strategy are:
to enable independent learning;
to support a diversity of student backgrounds;
to maintain staff workloads at a manageable level;
to minimise non-progression rates.
The statement of and the implementation of a strategy for fulfilling these aims within the newly-created faculty, has been somewhat delayed. It is now being undertaken by the faculty's Teaching and Learning Group, which is at present making good progress towards implementation at the start of 2003-4. However some aspects of the faculty's strategy are already clear, and are reflected in the design of this programme:
a consistent structure for awards, which minimises as far as possible the number of modules taken by a full-time student (while previous Masters schemes were based mainly on 10-credit modules with some 20-credit modules, the new programmes are based on 15-credit modules)
a consistent approach to transferable skills, with a policy (described elsewhere in this document) which ensures that a single set of skills is covered within the core modules of each award.

Other aspects of the eventual TLA strategy are likely to include module delivery, with an explicit strategy towards the delivery of modules in modes which enable the student to learn at times of his/her choosing, whether electronically, on paper, or otherwise. The aim will be to have, in due course, a small but significant part of the experience for most students based on such modules. The faculty's successful experience of the Blackboard pilot in 2002-03 will be of benefit in implementing this; nevertheless there are significant implications for such a move in respect of staff development, and the faculty intends to address these as part of the preparation for the strategy.

8.7. Research

The Faculty's research strategy and its implementation are described more fully in Part 3 of the documentation.

Our areas of expertise in research span the full range of computing, engineering and mathematics disciplines, and a good deal of the research is cross-disciplinary, both within CEMS, and linking with other UWE Faculties. The majority of the Faculty's research is organised into formally constituted Research Centres or informal Research Groups. The Faculty currently has seven Research Centres: the Aerospace Research Centre (ARC), the Centre for Complex Cooperative Systems (CCCS), the Community Information Systems Centre (CISC), the Centre for Innovative Manufacturing and Machine-vision Systems (CIMMS), the Engineering and Medicine Elastomers Research Centre (EMER), the Intelligent Autonomous Systems laboratory (IAS) and the Intelligent Computer Systems Centre (ICSC). The main research groups include the Computational Mechanics group, the newly formed Music Systems Research Group, the Power Electronics and Energy Systems Group (PEESG) and the Quality Systems Research Group (QSRG). Established research groups in Mathematical Sciences cover Complex Fluids, Acoustics, Nonlinear Dynamics and Differential Geometry.

The Faculty's research is funded from a wide range of sources including the European Union (EU), the Engineering and Physical Sciences Research Council (EPSRC), Teaching Companies Directorate (TCD), the Department of Trade and Industry (DTI) and direct from industry. The research spans the whole spectrum of activity from theoretical (blue-skies) investigation through to contract and consultancy for industry. The Faculty actively seeks technology transfer opportunities with industry and, notably, has a current 'flagship' TC programme with Motorola, Swindon. The Research is managed by a Research Executive consisting of the seven Research Centre Directors, five Research Leaders (one in each of the Faculty's schools), the Director of the CEMS Graduate School and the Associate Dean (Research). Research Centre Directors are strongly focused on advanced the work of their centres, whereas the Research Leaders are concerned with supporting and developing less experienced research academics within the Schools. In addition to academic staff engaged in research, the Faculty employs about 50 salaried research staff within funded projects. Within its Graduate School the Faculty has around 100 full-time and part-time research degree students, studying for MPhil or PhD awards.

It follows from the cross-disciplinary nature of the Faculty's research that there is not a simple one-to-one relationship between research centres or groups, and the proposed MSc programmes. Instead, the Faculty's research provides a rich underpinning, in which multiple research activities inspire, inform and provide materials, case studies and projects into each MSc programme. The primary linkages may be best illustrated in a matrix, as follows:

	ARC	**CCCS**	**CISC**	**CIMMS**	**EMER**	**IAS**	**ICS**	**Mathematical Science**
Advanced Technologies in Electronics	X			X		X	X	
Computer Science		X					X	
Engineering & Technology Management	X			X	X			X
Information Technology			X				X	
Statistics & Management Science				X				X
Software Engineering			X			X		

8.8. Staff Development

The Faculty operates a policy of staff development which is fully inclusive and covers academic staff, visiting lecturers, technicians and research staff.

All academic staff participate in the university-wide appraisal scheme which operates on a two year cycle with an intermediate review. The system is based on self-review and results in an agreed action plan for the development of each individual staff member. Technical and administrative staff operate a similar scheme.

Academic staff workloads are managed so as to allow time for personal scholarship and development, regardless of whether the individual is an active researcher. Each member of academic staff is expected to prepare a Personal Scholarship Plan, updated annually, including objectives for personal goals in pursuit of the faculty's collective goals.

Staff development is seen as an ongoing process which may combine extending subject based knowledge, becoming involved in research and consultancy and developing management and leadership skills. Staff development events are held at certain times of the year aimed at specific aspects of our work or skills such as teaching and learning methods

or new method of assessment. Staff are encouraged to seek membership of professional bodies and to obtain ILT membership. Another vehicle used for staff development is team teaching, which is incorporated into modules at all levels. During this academic year, staff development events have focussed on spreading awareness of 'Blackboard' (the university's new Virtual Learning Environment) and on encouraging and enabling staff to increase the number of bids for external research support.

Each of the five schools in the Faculty has an annually determined budget for staff development (for 2001/2002 £10K per school, approximately £400/FTE academic staff) which provides the opportunity for staff to attend relevant training courses and conferences. In addition to this, the Faculty retains a larger central budget for staff development, travel and conference attendance (for 2001/2002 £30K). A separate budget is made available each year for technical and administrative staff development.

One of the primary vehicles for staff development is through conference attendance and by undertaking and then publishing research work and other scholarly activity. These activities are part of the core definition of a UWE academic and can be supported by designated staff development budgets or through funded projects. A table is attached which shows a record of conference attendance and publications most relevant to this application for the period 2000/2002.

All academic staff are eligible for staff training and development. Take up of staff development opportunities is very high. Staff development budgets are usually fully spent each year. In addition, newly appointed academic staff are required to attend the university's Professional Development Programme, leading to an ILT accredited PGCE in Teaching and Learning in Higher Education. In Part 3 of this documentation there appears a summary of the attendance at conferences and other external staff development events undertaken by academic staff of the faculty over the past year.