Faculty of
Computing, Engineering
and Mathematical Sciences

BRISTOL

Faculty of Computing, Engineering & Mathematical Sciences

MEng/BEng(Hons) Electronic Engineering

October 2004

Programme Specification

Section 1: Basic Data

Awarding institution/body	University of the West of England
Teaching institution	University of the West of England
Faculty responsible for programme	Computing, Engineering and Mathematical Sciences
Programme accredited by	BEng(Hons) by Institution of Electrical Engineers
Highest award title	MEng/BEng(Hons) Electronic Engineering
Default award title	
Interim award title	Certificate of Higher Education Diploma of Higher Education
Modular Scheme title (if different)	
UCAS code (or other coding system if relevant)	
Relevant QAA subject benchmarking group(s)	Engineering
On-going	
Valid from (insert date if appropriate)	
Authorised by…	**Date:…**

Version Code: 1

For coding purposes, a numerical sequence (1, 2, 3 etc.) should be used for successive programme specifications where 2 replaces 1, and where there are no concurrent specifications. A sequential decimal numbering (1.1; 1.2, 2.1; 2.2 etc) should be used where there are different and concurrent programme specifications

Section 2: Educational Aims of the Programme

- The aim of the Faculty's MEng programmes is to respond to the need for effective engineering practitioners by offering programmes that are an intellectually challenging mix of taught engineering science and experiential learning. The practitioner approach is intended to produce engineers with a strong orientation towards problem solving, underpinned by theoretical knowledge.

- The aim of the programme is to produce graduates with a broad understanding of electronic engineering, combining sound knowledge of the technological fundamentals of the subject with awareness of engineering practice, information technology, management and marketing issues.

- In addition, graduates with MEng, through extended study of specialist subjects in electronics design using FPGA, embedded processors and intelligent systems, will be equipped to solve problems and lead future developments in the electronics industry.

- The Electronic Engineering programme produces graduates with a wide range of expertise relevant to the electronics industry. The programme covers a broad range of disciplines such as digital and analogue circuit design, power electronics, control, signal processing and project management. A number of developments have occurred in electronics in recent times. Although, signals are analogue in nature, many electronic designs involve conversion to digital format as soon a possible and processing by microprocessor or digital integrated circuit. In recognition of this change, this programme allows students to develop expertise particularly in integrated circuit design and microprocessor hardware/software design. The developments in intelligent systems techniques has created exciting new application areas for electronics design, whether it be processor-based or through FPGA implementation of intelligent systems algorithms.

The aims of the programme are therefore that the graduate shall:

1. gain a sound knowledge and understanding of the fundamental principles governing the behaviour of electronic devices and circuits and of the related mathematics;
2. be capable of both qualitative and quantitative analysis of the behaviour of complex electronic devices and circuits and be able to deduce their effect on those systems with which they interact, by application of (1) above;
3. demonstrate a capacity for innovative and creative circuit design and be able to draw on knowledge of fundamental principles and proven systems to further develop existing circuits and to generate new circuit designs which meet required specifications;
4. understand the technical and non-technical constraints imposed on a new circuit design by standard engineering design practices, costs, manufacturing procedures and production processes;
5. have an broad knowledge and understanding of engineering theory, practices and applications and be able to use advanced techniques of analysis, synthesis and implementation in the field of electronic design, including digital electronics, analogue electronics and power electronics, and be familiar with the use of microprocessors, control systems, communications, signal processing and intelligent systems techniques;
6. have a sufficient understanding of the methods of industrial organisation for he/she to be able to participate usefully in commercial decision making; in particular, the graduate should operate effectively as a member of a multidisciplinary team, have an understanding of the principles of marketing and financial control and, in making management decisions, should consider the impact of law and economics;
7. have developed the ability, interest and motivation to conduct independent study and keep abreast of future changes in technology and engineering practices;
8. be able to communicate clearly, concisely and persuasively with individuals and groups, within and outside the profession, both orally and in writing.

Section 3: Learning Outcomes of the Programme

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, intellectual skills, subject-specific skills and transferable skills., as shown below.

A. Knowledge and Understanding

Knowledge and Understanding of:	*Teaching/Learning Methods and Strategies*	*Assessment*
1. The principles of electrical and electronic components and circuits. 2. Mathematical methods appropriate to electronic engineering and related fields. 3. The properties and characteristics of materials used in electrical and electronic components and systems. 4. Core engineering science and technologies with greater depth in areas pertinent to electronic circuit design, including analogue, digital and embedded processor-based systems. 5. The principles of information technology and data communications. 6. Management principles and business practices. 7. The complexity of large-scale engineering systems and projects, with particular emphasis on electronic solutions and systems.	Acquisition of 1 to 7 is through a combination of formal lectures, tutorials, laboratory work, guided project work, group assignments, independent projects and case studies. The programme of study is designed to introduce basic knowledge and understanding of the technologies underpinning electrical & electronic engineering, design and product development through a range of level 1 modules. This basic knowledge is developed through a range of taught modules at level 2, and integrated through group design and project work at levels 2, 3 and M. Advanced tools and technologies are studied in the final years of the programmes, and the programme as a whole is integrated through the BEng individual project at level 3 or MEng individual project at level M. Throughout the programme, the learner is encouraged to undertake the practical application of theory knowledge learnt in other modules. Independent learning through reading and use of appropriate software is encouraged both to supplement and consolidate what is being taught/learnt and to broaden the individual knowledge and understanding of the subject. This is further emphasised in the project modules, UFPED7-30-M (group project) and UFEE6V-60-M (individual project).	The outcomes are assessed in the core award-specific module through a variety of methods, including exams under controlled conditions and coursework assignments, some of which are based on practical laboratory investigations. Optional modules will provide knowledge and understanding of concepts, tools and techniques appropriate to the overall aims of the programme.

B. Intellectual Skills

Intellectual Skills	*Teaching/Learning Methods and Strategies*	*Assessment*
1. The ability to produce solutions to complex problems through the application of engineering knowledge and understanding. 2. Be able to use scientific principles in the modelling and analysis of electronic engineering circuits, processes and products and be able to assess the limitations of particular cases. 3. The ability to select and apply appropriate mathematical methods for modelling and analysing relevant problems and be able to assess the limitations of particular cases. 4. The ability to use a broad spectrum of technologies and techniques to solve complex engineering problems, particularly in the electronic engineering domain. 5. Be able to use scientific/technological principles in the development of engineering solutions to practical problems in the domain of electronic engineering, with regard to the broad area of electronic circuit design. 6. The ability to select and apply appropriate computer based methods for modelling and analysing problems in fields relating to the design, manufacture and control of electrical and electronic components and circuits, particularly those involving analogue, digital and microprocessor-based electronics. 7. The ability to understand issues relating to the marketing of products and the management processes associated with their design and manufacture. 8. A professional attitude to the responsibilities of engineering practitioners. 9. The ability to use independent thinking and analysis in the development of engineering solutions. 10. Critically review available literature on topics related to engineering	At all levels students are required to bring together knowledge and skills acquired in several modules and hence determine new ways of working. As the student progresses, the need to synthesise ever-greater volumes of information and approaches into a coherent approach is developed and consequently so is their critical thinking. At level 1, analysis, evaluation and problem solving are developed on small-scale problems in various programming activities in a number of modules. Here the focus is on understanding the problem and then solving it free from the environmental implications of real-world problems and without the need to examine alternatives and to balance conflicting goals. At level 2 there is a move away from small-scale problems to the design of larger scale systems. With this comes the need to evaluate alternative methods and designs and to balance conflicting objectives. Level 3 sees the move to specific application examples and with it the need to appreciate problem contexts is developed as well as striking the right balance when facing conflicting objectives. Work at level M focuses on skills 8-10, and requires independent thinking, information gathering and analysis. This is delivered through a combination of specialist taught modules plus group and individual project work.	The development of engineering solutions requires demonstration of all of the intellectual skills. At level 1 the focus is on the skills of Analysis, Evaluation and Problem Solving. At levels 2, 3 and M this branches out to include all the remaining skills. Independent reading is used to enable students to focus on their own areas of interest and in the process assess skills in submitted reports, assignments and exam answers. Electronic Engineering work requires demonstration of a very wide range of skills (1 - 7). These skills are assessed through a combination of coursework assessments, projects and examinations.

C. Subject, Professional and Practical Skills

Subject/Professional/Practical Skills	***Teaching/Learning Methods and Strategies***	***Assessment***
Students will be able to: 1. use appropriate mathematical methods for modelling and analysing problems, particularly in electronics design. 2. apply appropriate computer based methods for modelling and analysing problems in fields relating to the design, manufacture and control of electronic components and systems. 3. use relevant design, test and measurement equipment. 4. apply experimental methods in the laboratory relating to engineering design, manufacture and test. 5. undertake practical testing of design ideas through laboratory work or simulation with technical analysis and critical evaluation of results. 6. apply engineering techniques taking account of industrial and commercial constraints. 7. execute and manage multi-disciplinary projects.	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. Tutorials consolidate material introduced in the lecture environment, which together with laboratory practice using appropriate software, facilitate application of theory to practical problems. Many of the skills listed are introduced at level 1 and then drawn into sharper focus at levels 2 and 3. The general teaching/learning method is therefore to impart these practical and professional 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. These are underpinned by the more generalised capabilities that are practised throughout the levels in most of the modules that contribute to the award.	The possession of these skills is demonstrated by the development of practical laboratory work, coursework, presentations and examinations. The practical nature of the skills to be acquired means that some are specifically addressed by particular modules, whilst the more generic skills are assessed across a range of modules.

D. Transferable Skills and Other Attributes

The skills developed in parts B and C above are highly valued in other areas and as such are highly transferable, for example:

1. problem structuring and formulation;
2. the critical interpretation of results to problem solving and analysis ;
3. ability to synthesize practical solutions from abstract problem formulations;

Transferable Skills and Other Attributes	*Teaching/Learning Methods and Strategies*	*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".	1. Skill one is developed through a variety of methods and strategies including the following: ♦ Students maintain laboratory log books ♦ Students participate in electronic conferences, workshops, and groupwork sessions. ♦ Students participate in discussion tutorials ♦ Students present research topic findings in tutorials ♦ Students participate in individual tutorials ♦ Students collaborate on group projects	These skills are demonstrated in a variety of contexts including • examination • poster presentation. individual and group projects • Practical assignments • Portfolio of exercises
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 systems 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 in the context of problem-solving investigations, and to interpret findings)	3. Skill three is developed widely throughout the programme.	

4. Problem formulation: To 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 ♦ 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 develop problem-solving programs ♦ Students are encouraged to research relevant topics ♦ Students are encouraged to use online facilities to discover information	
6. Comprehension 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 ♦ Both MEng Group and Individual Projects require a thorough literature review	
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.	7. Skill seven is developed through a variety of methods and strategies including the following: ♦ Students work in groups in some laboratory sessions ♦ The MEng Group Project	

Section 4: Programme Structure ***Note: This structure is indicative and subject to change***

Programme Structure for **M/Beng Electronic Engineering**

MEng Year 4

Meng Individual Project UFEE6V-60-M	60 credits Option 3

MEng Year 3

Meng Group Project UFPED7-30-M	Project Management UFEE6D-10-3	60 credits Option 1	20 credits Option 2

BEng Year 3

Individual Project (Electronics) UFEE63-30-3	Project Management UFEE6D-10-3	60 credits Option 1	20 credits Option 2

Year 2 P (Industrial Placement Year)

M/BEng Year 2

Embedded Microprocessor Systems UFEE69-20-2	Signal Processing and Control UFEE7S-30-2	CPU Architecture and VHDL UFSEHH-30-2	Engineering Mathematics 2 UFQEFK-10-3	Engineering Mathematics 3 UFQEFL-10-2	Industrial Studies UFPEDE-20

M/BEng Year 1

Analogue Circuit Principles UFEE79-20-1	Software Development for Engineers UFEE7A-20-1	Digital Electronics UFEE7B-20-1	Electronics Design UFEE7C-40-1	Engineering Mathematics 1 UFQEFH-20-1

Option 1 taken from	
UFEE5L-20-3	Digital Signal Processing
UFEE5M-20-3	Power Electronics
UFEE5S-20-3	VLSI Circuit and System Design
UFEEKB-20-3	Microcomupter Control Systems

Option 2 taken from	
ILP	Modern Language
Option 1	Not already chosen
UFEE5W-20-3	Control Systems Design
UFEE77-20-3	Telecommunication Systems
UFEE78-20-3	Mobile Communications
UMAC3P-10-3	Man. Accounting in a Business Context
UMSCCA-10-3	Marketing and Strategic Management

Option 3 taken from	
UFEE7G-15-M	Behavioural System Design
UFEE7K-15-M	Intelligent & Adaptive Systems
UFEE7L-15-M	Mobile Communications
UFEE7N-15-M	Neural Networks & Fuzzy System
UFPEE7-15-M	Operations Management & Improvement
UFSEHT-15-M	Embedded Real Time Systems

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

Section 5: Entry Requirements

The admissions requirements are similar to comparable awards offered in the Faculty of CEMS. For MEng and BEng(Hons), the standard offer will be 260 points and 180 points respectively at A-level, to include Mathematics (minimum C grade) and a Physical Science. Equivalent qualifications will also be accepted in lieu of A-levels. Courses in the Faculty of CEMS typically have a high proportion of students with BTEC or equivalent vocational qualifications and those who progress through the Foundation Programme.

Section 6: Assessment Regulations

The Modular Assessment Regulations apply to this programme

Section 7: Student Learning: Distinctive Features and Support

Class Activities The mode of delivery of a module is determined by its Module Leader, and typically involves a combination of one or more lectures, tutorials, 'lectorials', laboratory classes, group activities and individual project work. Modules which require laboratory classes are commonly delivered by means of a combination of lecture and practicals or tutorials. Other modules are often delivered by means of 'lectorials', classes for groups of 20-30 students with no distinction between lectures and tutorials.

Academic Support Academic advice and support is the responsibility of the staff delivering the module in question. Staff are expected to be available outside normal timetabled hours, either by appointment or during published "surgery" hours, in order to offer advice and guidance on matters relating to the material being taught and on its assessment.

Students are allocated a Personal Tutor at the beginning of the programme. The Tutor assists the student to develop a professional attitude to their studies, reflect on their study skills needs and to see the inter-relations between the various modules at different levels of the programme. A course of lectures relating to Professional & Academic Development reinforces the work of the Tutors. Further topics are covered in later years of the programme leading the students creating a Professional & Academic Development Portfolio highlighting the knowledge, skills and experiences gained on the course.

Pastoral Care The faculty's offers pastoral care through its Student Advisers, a team of staff who provide comprehensive, full-time student support service on a drop-in basis or by appointment. All students on the same route are allocated to the same Adviser, who is trained to provide advice on matters commonly of concern, including regulatory and other matters; the Adviser will, when necessary, advise the student to seek advice to from other professional services including the university's Centre for Student Affairs or from members of academic staff.

Progression to Independent Study
Many modules require students to carry out independent study, such as research for projects and assignments, and a full range of facilities are available at all sites to help students with these. The philosophy is accordingly to offer students both guided support and opportunities for independent study. Guided support, mainly in the form of timetabled sessions, takes the form of lectures, tutorials, seminars and practical laboratory sessions. Students are expected to attend all sessions on their timetable, and this is especially important because of the high content of practical work in the programme.

The progression to independent study will also be assisted by the nature of the support offered in individual modules. Typically, module leaders will provide a plan for the module indicating the activities to be carried out and the forms of learning to be undertaken during the delivery of the module, with a view to encouraging students to plan ahead and to take responsibility for managing their time and resources.

Facilities to Support Learning Within the Faculty of Computing, Engineering and Mathematical Sciences, student learning will be supported in the following distinctive ways :

- Through provision of Open Access and other available computer laboratories that provide access to a range of relevant computer based applications
- Through provision of the CEMS System Support Helpdesk that provides a range of support for learning to students including :
    - Support for a wide range of applications used by the students;
    - Help in the form of Assistants who are trained to resolve many common student problems
    - And help in the form of a large set of 'help-sheet documents', developed over a number of years, that cover a variety of common student requests for information.
- Technical support staff are available in laboratory sessions and during project work.
- Through very extensive laboratory facilities to support the technological modules. These focus on
    - The Power Systems and Electronics Laboratory (1N65) with experimental and computer simulation design tools for power electronics.
    - The Real Time Control and Telecommunications Laboratory (2N40) with facilities for control system analysis and design, embedded microprocessor hardware and software development, and signal processing and communications. Digital Signal Processing facilities are also available in 3P28.
    - The Electronics Laboratory (1N70) with facilities for investigation of electrical and electronic principles and circuit design, build and test.
    - The Real Time Systems Laboratory (3P11) with further facilities for design of embedded processor systems.
    - The Computer Networks Laboratory (3P27) which provides facilities for students to set up and administer communication networks.
    - VHDL facilities in 3P28 and the VLSI CAD suite (4E22) which allow students to design electronic solutions using FPGA and full-custom VLSI.

Computing Facilities The Faculty offers a specialised computing facility along side the general University provisions. There are nine general PC computing laboratories of 20 plus seats all running Windows2000, along with four Unix based laboratory and 10 specialist computing labs. The specialist laboratories are equipped with the specific software for CEMS students; including Software Design Tools development environment, CAD, finite element analysis, mathematics and statistics packages to support the taught program. The specialist Computing laboratories are designed to target the discipline taught in that area. Amongst these, is the Computer Systems Architecture and Linux laboratory. The Unix labs offer the latest web development and programming tools.

One of the most popular areas within the Faculty is the Open Access laboratory. This area is never time-tabled and gives students the opportunity to access machines at all times during opening hours. This is a mixed environment consisting of PCs and Unix workstations.

Due to the extensive computing facility provided within the Faculty, and the specialist nature of this facility, the need for user support is necessary. The Faculty provides a user support Helpdesk. The Helpdesk provides fist line support to the user base, uniquely supported by both permanent staff and students that are in their second or final year of study (employed on a part time basis) until 20.00hrs every day. These general purpose and specialist laboratories are available to students up until midnight, seven days per week.

Section 8 Reference Points/Benchmarks

In designing this programme, the faculty has drawn upon the following external reference points:

1. The QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland
2. The QAA Benchmark Statement for Engineering
3. UWE's Learning & Teaching Strategy

The QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland describes the attributes and skills expected of Honours graduates. It is our view that the learning outcomes of this programme are fully consistent with the qualification descriptor in the Framework, and hence that graduates will be able to demonstrate that they meet the expectations of the Framework.

The **QAA Subject Benchmark Statement for Engineering** outlines a set of skills expected of a graduate in an engineering discipline (Section 4 of the Statement refers), while noting that they should be interpreted in the context of the particular engineering discipline which is being studied. These skills map closely to the skills contained in the learning outcomes for this programme, and hence we have confidence that the programme is in accordance with the precepts of the Statement.

UWE's Learning & Teaching Strategy has informed the faculty's policy for the delivery of its programmes, whose main features are described in section 7.