PROGRAMME SPECIFICATION

Course Record Information	
Name and level of **final** & intermediate Awards	**BSc Honours Electronic Engineering** **BSc Honours Electronic Engineering (Sandwich)** BSc Electronic Engineering BSc Electronic Engineering (Sandwich) Diploma of HE in Electronics Certificate of HE in Electronics
Awarding Body	University of Westminster
Location of Delivery	University of Westminster, New Cavendish Street, Central London
Mode of Study	Full time/Sandwich
UW Course Code	U09FUELC U09FFELC with Foundation
JACS Code	H6
UCAS Code	H601 H607 with Foundation
QAA Subject Benchmarking Group	Engineering
Professional Body Accreditation	IET
Date of initial course approval/last review	2005
Date of Programme Specification	Sept. 2010

Admissions Requirements

Students who had their secondary education in the UK should have at least 5 GCSE passes at Grade C or equivalent including English Language and Mathematics. The University normally requires all undergraduate applicants who have not had their secondary education through the medium of English to attain the equivalent of IELTS 6.0, Cambridge Proficiency, or TOEFL 550 (paper)/80 (internet).

As well as these, applicants should meet one of the requirements listed below:

- **A-Level Entry**
  At least two subjects passed in the General Certificate of Education at Advanced Level, one of which must be a technological subject (e.g. Mathematics, Technology, Physics, Engineering, Engineering Science, Electronics or Electronic Systems). Usually, A-level grades of at least CCD (or AB) will be required.
- **Advanced Diploma Entry**
  The award of an Advanced Diploma in Engineering. Usually, a Grade C plus relevant Additional Specialist Learning (ASL) at Grade C would be required.
- **National Diploma/Certificate Entry**
  The award of a BTEC National Diploma or Certificate in Engineering. Usually, diploma grades of MMM or certificate grades of AA will be required.
- **Foundation Course Entry**
  The award of a Certificate or Diploma upon completion of an approved foundation or access course.
- **Other Entry**
  Candidates holding qualifications differing in detail but not in standard from the above (e.g. an approved Secondary Leaving Certificate such as the International Baccalaureate with acceptable grades in relevant subjects) may be considered eligible for admission to the

Course Record Information	

courses.

Direct Entry to Level 5 (Year 2): Candidates who have successfully completed studies comparable in content and standard to the Level 4 of the Course, including a practical skills component, may be considered for direct entry to the second year of the Course.

Where possible, all applicants are interviewed and may be given an aptitude test.

Aims of the course

The course is designed to meet the demand from employers for graduates with application-oriented engineering skills and know-how. In particular, it is targeted towards the rapidly growing and changing industries involving electronic and telecommunication systems. Because of the interest in these technologies among students without the "traditional" engineering background of advanced mathematics and physics, the course is designed to include teaching of these underpinning skills.

The course aims to:

- Provide an enjoyable learning experience which will serve as a solid intellectual basis for a professional engineering career in the electronics, telecommunications or related fields.
- Establish fundamental principles of electronics, mathematics and computing, and develop the connection between these and a broad range of engineering systems.
- Encourage initiative and confidence in approaching engineering problems and adoption of an investigative approach to their solution using a blend of analytical and practical skills.
- Develop skills in presentation of technical work, the interpersonal and organisational requirements associated with carrying out an engineering project, and an appreciation of the industrial and social context of the technology.
- Give an understanding of the role and responsibilities of the professional engineer to society and the environment.
- Engender the communication and interpersonal skills necessary for operation in a professional engineering environment and to provide an education that allows graduates to adapt the future changes in technology.

The supplementary aims of the **sandwich mode** of attendance are to provide students with relevant workplace experience and to launch their initial professional development with a view to becoming an Incorporated Engineer.

Employment and Further Study Opportunities

This course was developed in response to an industry need and with syllabus contributions from Nokia, Orange, the BBC and Channel 4.

Today, industry, commerce and every part of society depend on electronic systems. It is possible to design a complete system inside a single microcircuit. This course provides a solid foundation in the theory, practice and application of electronic and communication systems.

Students on the Department's degree courses have gone on to work for the BBC and electronics giants such as BT, Nokia, British Aerospace and GEC, and to smaller private companies. Some have started up their own businesses in manufacturing or consultancy. Opportunities also exist for postgraduate study leading to Masters and PhD qualifications.

Learning Outcomes

Learning outcomes are statements on what successful students have achieved as the result of learning. They threshold statements of achievement and are linked to the knowledge, understanding and skills that a student will have gained on successfully completing a course.

Course Record Information	

Intermediate Learning Outcomes

Level 4: students will be able to:

- demonstrate understanding of basic physical and mathematical laws governing the operation of electronic circuits and systems;
- demonstrate some knowledge of current technology, applications and techniques as taught.
- read, use and create simple descriptions in words, mathematics or diagrams of electronic, software and mathematical concepts, and use these in the description and analysis of simple systems;
- analyse simple real-world problems and synthesise appropriate solutions using given engineering techniques;
- given prescribed methods, design, implement, debug and test, simple analog and digital circuits, programs in high-level and low-level languages and mathematical models of signal processing and communication systems.
- work on structured group tasks, given direction and guidance, collaborating in the production of practical products and documentation;
- communicate technical information correctly, by means of presentations, written reports, appropriate diagrams and discussion;
- gather and assimilate information as directed and apply it as instructed;
- manage their learning as directed, keeping to set deadlines.

Level 5: students will be able to:

- demonstrate understanding of mathematical laws governing the operation of discrete and analog electronic circuits and systems;
- demonstrate an awareness of the industrial and social context of electronic engineering;
- demonstrate knowledge of current technology, applications and techniques.
- read, use and create descriptions in words, mathematics or diagrams of electronics, software and mathematical concepts, and use these in the description, analysis and interfacing of systems;
- analyse given real-world requirements and synthesise appropriate solutions from standard engineering techniques;
- selecting from well-defined methods, design, implement, debug and test analog and digital circuits, programs in high-level and low-level languages and mathematical models of signal processing and communication systems;
- approach an engineering problem in a disciplined fashion, making decisions with support and assistance.
- work on structured group tasks, collaborating in the production of complex practical products and documentation;
- communicate complex technical information succinctly and accurately, by means of presentations, written reports, appropriate diagrams and discussion;
- gather and assimilate information with some guidance and apply it appropriately;
- manage project work, sticking to given timetables and structure.

General Learning Outcomes

Course Record Information	

Graduates will satisfy the following criteria:

Knowledge and Understanding: they will be able to demonstrate their knowledge and understanding of essential facts, concepts, theories and principles pertaining to electronic engineering, and its underpinning science and mathematics. They will have an appreciation of the wider multidisciplinary engineering context and its underlying principles. They will appreciate the social, environmental, ethical, economic and commercial considerations affecting the exercise of their engineering judgement.

Intellectual Abilities: they will be able to apply appropriate quantitative science and engineering tools to the analysis of problems. They will be able to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs. They will be able to comprehend the broad picture and thus work with an appropriate level of detail.

Practical skills: they will possess practical engineering skills acquired through, for example, work carried out in laboratories and workshops; in industry through supervised work experience; in individual and group project work; in design work; and in the development and use of computer software in design, analysis and control.

General transferable skills: they will have developed transferable skills that will be of value in a wide range of situations. These skills include problem solving, communication, and working with others, as well as the effective use of general IT facilities and information retrieval skills. They also include planning self-learning and improving performance, as the foundation for lifelong learning/CPD.

Specific Learning Outcomes

1. Underpinning Science and Mathematics

Graduates will be able to demonstrate:

- Knowledge and understanding of the scientific principles underpinning electronic and communication engineering, and their evolution;
- Knowledge and understanding of mathematics necessary to support application of the key engineering principles in electronic engineering.

2. Engineering Analysis

Graduates will be able to demonstrate:

- Ability to monitor, interpret and apply the results of analysis and modelling in order to bring about continuous improvement;
- Ability to apply quantitative methods and computer software relevant to electronic and communication systems engineering, frequently within a multidisciplinary context;
- Ability to use the results of analysis to solve engineering problems, apply technology and implement engineering processes;
- Ability to apply a systems approach to engineering problems through know-how of the application of electronic and communication technologies.

3. Design

Graduates will have the knowledge, understanding and skills to:

- Investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues;
- Understand customer and user needs and the importance of considerations such as aesthetics;

Course Record Information	

- Identify and manage cost drivers;
- Use creativity to establish innovative solutions;
- Ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal;
- Manage the design process and evaluate outcomes.

4. Economic, Social, and Environmental Context

Graduates will be able to demonstrate:

- Knowledge and understanding of commercial and economic context of engineering processes;
- Knowledge of management techniques which may be used to achieve engineering objectives within that context;
- Understanding of the requirement for engineering activities to promote sustainable development;
- Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues;
- Understanding of the need for a high level of professional and ethical conduct in engineering.

5. Engineering Practice

Graduates will be able to demonstrate practical application of engineering skills, combining theory and experience, and use of other relevant knowledge and skills.
This includes:

- Knowledge of characteristics of protocols, equipment, processes, and products in the electronic and communication industries;
- Workshop and laboratory skills;
- Understanding of contexts in which engineering knowledge can be applied including operations and management, technology development, etc;
- Understanding use of technical literature and other information sources;
- Awareness of nature of intellectual property and contractual issues;
- Understanding of appropriate codes of practice and industry standards;
- Awareness of quality issues;
- Ability to work with technical uncertainty.

Teaching, Learning and Assessment Methods

Teaching and Learning Methods

The fundamental principle underlying the teaching methods used on this course is “learning by doing”. That is, in order to learn and understand the engineering skills and techniques required, students cannot just be told them or read about them - they need to practise them.

The following teaching methods are used

- Lecture / seminar sessions
- Projects (group and individual)

Course Record Information

- Laboratories and computer-aided engineering
- Problem sheets, investigations and design
- On-line learning

Lecturers provide written and verbal feedback on students' work throughout the course. This may be individual or for the whole class.

Most of the mathematics in this course is taught within the engineering modules which use it. This means that students learn the mathematical theory and how it is applied at the same time, so as to make it more obviously relevant.

Unlike some programmes with a wide choice of separate modules, this course builds on tightly interrelated themes. They have been designed to fit together, and it is vital that knowledge and skills feed across from one subject to another. Staff teaching the modules have experience across a range of engineering areas, and will expect students to develop the same without compartmentalising ideas.

Assessment Strategy

These modules share a common assessment strategy. As well as checking that students have met the learning outcomes of the module, assessment will, where possible and appropriate, be:

- formative (helping students to learn);
- rigorous (not easily copied, or otherwise passed without appropriate knowledge and skill);
- challenging (requiring understanding, not just memorising of facts or mathematical tricks);
- workplace relevant (the sort of tasks engineers might be judged on by an employer);
- interesting (relevant to the application of the subject).

Modules may have between one or two aspects of assessment making up the total mark. There are minimum marks for each aspect. This means, for example, that students cannot make up for a very poor exam mark by getting an excellent coursework mark nor can they depend on a good group mark, due to the efforts of other group members, to compensate for a very poor individual mark. A wide variety of assessment methods are used, including

- In-class tests (making up the majority of coursework marks)
- Group work
- Laboratories
- Viva-voce examinations
- Formal examinations
- Written reports
- Presentations and posters
- Computer-based quizzes and exercises
- Design and implementation of hardware and software
- Analysis, testing and modification of existing hardware or software
- Participation in class activities such as question-and-answer sessions

Course Structure

This section shows the core and option modules available as part of this course and their credit value. Undergraduate students normally study 120 credits per year. Modules marked * are project-based.

Credit Level 4

Code	Title	Status	Value
EECT405	Digital Systems	Core	15
EECT401	Computer Systems Project *	Core	15
EECN410	Engineering Programming	Core	15
EEEL420	Electronics	Core	15
EEEL425 EEEL400	Maths for Electronics OR Engineering Principles	Core	15

Course Record Information

EEEL430	Circuits and Systems	Core	15
EECN401	Computer Networks and Communications	Core	15
EEEL440 1EAPP04	Engineering Problem-Solving Skills OR English for Academic Purposes (overseas only)	Core	15

Award of Certificate of Higher Education available

Credit Level 5

Code	Title	Status	Value
EECT520	Event-Driven and GUI Programming	Core	15
EECT510	Embedded Microprocessor System Project *	Core	15
EEEL515	Analog Electronic Design Project *	Core	15
EECT505	Microelectronic and FPGA System Design Project *	Core	15
EECT525	Professional Engineering Practice	Core	15
EEEL520	Communication Signal Processing	Core	15
EEEL525	Communication Systems	Core	15
EEEL530	Broadcast Media Systems	Core	15

Award of Diploma of Higher Education available

Credit Level 6

Code	Title	Status	Value
EEEL625	Digital Signal Processing	Core	15
EEEL630	Mobile Radio Systems	Core	15
EECT625	Industrial Management	Core	15
EEEL635	Cellular Radio Networks	Core	15
EECT699	Individual Project *	Core	30
	Plus **two option modules** from below:		
EEEL640	Video Broadcasting	Option	15
EEEL645	Sound Processing Systems	Option	15
EECT600	Real-Time Embedded Systems	Option	15
EEEL620	Analog Microelectronics	Option	15

Award of BSc available.
Award of BSc Honours available.

Assessment of Modules

A *pass* in a module is achieved when the overall mark is at least 40% and the marks for separate aspects of assessment are individually at least 30% (for coursework/exam aspects) or at least 35% (for group-work/individual-work aspects).

At Level 4 only, a student who has failed certain elements of assessment may be awarded *condoned credit* in a module where he/she has achieved:

(a) an overall module mark of greater than or equal to 30% but less than 40%;

(b) an overall mark of 40% or greater but not reached the required standard in one or more aspect of assessment.

Where a student is awarded condoned credit, the recorded module mark will be capped at 39%. To be awarded a condoned credit the failed elements of assessment must have been attempted at *both* the first and referred opportunity.

Where a student is awarded condoned credit in a module but subsequently achieves an overall pass at a re-attempt, credit may contribute only once to an award.

Course Record Information	

Condoned credit cannot be awarded for modules at levels 5 or 6.

Progression Requirements

The University has regulations that govern the progression through the course.

In order to progress to Level 5, a student must obtain a minimum of 90 credits passed (i.e. not condoned) at Level 4. In addition, a student must normally have an average of at least 40% across 120 credits.

In order to progress to Level 6, a student must normally obtain a minimum of 195 credits at Level 4 or above, including a minimum of 75 credits at Level 5 or above.

A student cannot normally attempt any module at the next level until they have fulfilled the above progression requirements to that level. In addition, specific prerequisites and co-requisites have to be met in order to study each individual module at Credit Levels 5 and 6.

Honours Award

In respect of the modules described in this course scheme, to qualify for the award of **BSc Honours Electronic Engineering** a student must:

(a) have obtained at least 360 credits including:

(i) a minimum of 120 credits at Level 4 or higher, of which no more than 15 shall be condoned; and

(ii) a minimum of 120 credits at Level 5 or higher, and

(iii) a minimum of 120 credits at Level 6 or higher, including the final-year individual project, and

[Note: for IET accreditation, the Individual Project credits must be obtained without retake.]

(b) have attempted modules worth no more than 330 credits at Levels 5 and 6. (An attempt includes a first attempt and any subsequent retake of any module but does not include reassessment without attendance.)

Honours Classification: The class of degree will normally be determined as follows:

First Class: An average of 70% or higher in the best modules worth 120 credits at Level 6, with an average of at least 60% in the best modules worth 120 credits remaining at Levels 5 and 6.

Upper Second Class: An average of 60% or higher in the best modules worth 120 credits at Level 6, with an average of at least 50% in the best modules worth 120 credits remaining at Levels 5 and 6.

Lower Second Class: An average of 50% or higher in the best modules worth 120 credits at Level 6, with an average of at least 40% in the best modules worth 120 credits remaining at Levels 5 and 6.

Third Class: An average of 40% or above in the best 240 credits at Levels 5 and 6.

To achieve the award **of BSc Honours Electronic Engineering (Sandwich)**, the conditions for the corresponding non-sandwich degree must be fulfilled plus the industrial placement must have been assessed as successfully completed.

The classification of the sandwich degree will be determined by the same criteria as for the corresponding non-sandwich degree. The industrial placement will not contribute to the classification.

Intermediate Awards

Non-Honours BSc Degree: In respect of the modules described in this course scheme, to qualify for the award of **BSc Electronic Engineering** a student must:

(a) have obtained at least 300 credits including:

Course Record Information	

(i) a minimum of 120 credits at Level 4 or higher, of which no more than 15 shall be condoned; and

(ii) a minimum of 120 credits at Level 5 or higher, and

(iii) a minimum of 60 credits at Level 6 or higher, and

(b) have achieved a mark of at least 35% in the final-year project module.

The BSc Electronic Engineering may be awarded with **Merit** to a student whose marks average at least 60% across the best 150 credits at Credit Levels 5 and 6;

The BSc Electronic Engineering may be awarded with **Distinction** to a student whose marks average at least 70% across the best 150 credits at Credit Levels 5 and 6.

Diploma of Higher Education: In respect of the modules described in this course scheme, to qualify for the award of **DipHE in Electronic Engineering** a student must have obtained at least 240 credits including:

(i) a minimum of 120 credits at Level 4 or higher, of which no more than 15 shall be condoned; and

(ii) a minimum of 120 credits at Level 5 or higher.

The DipHE Electronic Engineering may be awarded with **Merit** to a student whose marks average at least 60% across the best 105 credits at Credit Level 5 or higher;

The DipHE Electronic Engineering may be awarded with **Distinction** to a student whose marks average at least 70% across the best 105 credits at Credit Level 5 or higher.

Certificate of Higher Education: In respect of the modules described in this course scheme, to qualify for the award of **CertHE in Electronic Engineering** a student must have obtained a minimum of 120 credits at Level 4 or higher, of which no more than 15 shall be condoned.

The CertHE Electronic Engineering may be awarded with **Merit** to a student whose marks average at least 60% across the best 105 credits at Credit Level 4 or higher.

The CertHE Electronic Engineering may be awarded with **Distinction** to a student whose marks average at least 70% across the best 105 credits at Credit Level 4 or higher.

Support for Students

On arrival, an induction programme will introduce students to the staff responsible for the course, the campus on which they will be studying, the Library and IT facilities and to the Campus Administration. Students will be provided with the Course Handbook, which provides detailed information about the course. Students are allocated a personal tutor who can provide advice and guidance on academic matters.

Learning support includes the Library which, across its four sites, holds printed collections of 412,000 books, 1,600 journal subscriptions and substantial audio visual collections. Access to over 6,500 electronic resources (databases, e-journals, e-books, exam papers and links to recommended websites) is facilitated through infoLinX, the library portal.

There are over 3,500 computers spread over the four University campuses available for students use. The University uses a Virtual Learning Environment called Blackboard where students can access course materials and communicate with staff and other students via message boards.

At University level, Services for Students provide advice and guidance on accommodation, financial and legal matters, personal counselling, health and disability issues, careers and the chaplaincy providing multi-faith guidance. The International Education Office provides particular support for international students. The University of Westminster Students' Union also provides

Course Record Information	

a range of facilities to support all students during their time at the University.

Reference Points for the course

Internally:

- University Quality Assurance Handbook and Modular Frameworks
- Staff research and development in Electronics and Communications
- Industrial advisory panel

Externally

Mainly:

- UK-SPEC (Engineering Council's UK Standard for Professional Engineering Competence) *The Accreditation of Higher Engineering Programmes*
- IET (Institution of Engineering and Technology) *Academic Accreditation Guidelines*
- QAA Subject Benchmark for Engineering

Also:

- QAA Guidelines for Preparing Programme Specifications
- SEEC Credit Level Descriptors for Further and Higher Education

Quality Management and Enhancement

Course Management
This course is managed by staff from the Department of Electronics, Networks and Computer Engineering (ENCE) in the School of Electronics and Computer Science. The Course Team consists of lecturers on individual modules, the Head of Department and technical support staff. The day-to-day running of each course is the responsibility of the Course Leader, while the strategic direction of the courses and the allocation of staff is the responsibility of the Head of the Department. The Dean of the School of Electronics and Computer Science takes overall responsibility for all departments within this School.

Course approval, monitoring and review
This course has been developed from and built upon similar courses previously approved by University Validation Panels. The Panels included internal peers from the University and external subject specialists from academia and industry to ensure the comparability of the courses to those offered in other Universities and the relevance to employers. Quinquennial Course Reviews help to ensure that the curriculum is up-to-date and that the skills gained on the courses continue to be relevant to employers.

Our courses are monitored each year by the School of Electronics and Computer Science to ensure that they are running effectively and that issues that might affect the student experience have been appropriately addressed. Staff will consider the outcomes from the Course Committee, evidence of student progression and achievement and the reports from External Examiners to evaluate the effectiveness of the course. The Campus Academic Standards Group audits these processes and the outcomes are reported to the Academic Council of the University, which has overall responsibility for the maintenance of quality and standards in the University.

Student involvement in Quality Assurance and Enhancement
Student feedback is important to the University and student comment is taken seriously. The most formal mechanism for feedback on the course is the course committee. Student representatives are elected to sit on the committee to represent the views of their peer group in

Course Record Information	
the discussions held at the committee. The University and the Students' Union work together to provide a full induction to the role of the Course Committee. Students are asked to complete an end-of module questionnaire at the end of each module. The feedback from this informs the Module Leader on the effectiveness of the module and highlights areas that could be enhanced. Students meet with Review Panels when the periodic review of the course is conducted to provide oral feedback on their experience on the course. Student meetings are also held on an annual basis with representatives of the School Academic Standards Group as part of the annual monitoring process.	
For more information about this course: Admissions tutor: Dr Mohammed Al-Janabi Course leader: Dr Viv Bartlett Web site: www.westminster.ac.uk/schools/computing/undergraduate/electronic-engineering	
Please note – This programme specification provides a concise summary of the main features of the course and the learning outcomes that a student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided. This specification should be read in conjunction with the Course Handbook provided to students and Module Handouts which provide more detailed information on the specific learning outcomes, content, teaching, learning and assessment methods for each module.	