PART ONE: PROGRAMME SPECIFICATION

Course Record Information	
Name and level of **final** & intermediate Awards	**MSc Computer Networks** **MSc Embedded Systems** **MSc Microelectronic System Design** **MSc Mobile, Wireless and Broadband Communications** PGDip Computer Networks PGDip Embedded Systems PGDip Microelectronic System Design PGDip Mobile, Wireless and Broadband Communications PGCert Computer Networks PGCert Embedded Systems PGCert Microelectronic System Design PGCert Mobile, Wireless and Broadband Communications
Awarding Body	University of Westminster
Location of Delivery	Cavendish
Modes of Study	Full-Time; Part-Time (Two-year); Part-Time (Three-year)
UW Course Codes	
QAA Subject Benchmark (where available)	Electronic Engineering Computer Science
Professional Body Accreditation (where appropriate)	IET/BCS
Date of initial course approval/last review	
Date of next Review/Re-validation	
Date of Programme Specification	May 2010

Admission Requirements

MSc Computer Networks:
Qualifications equivalent to a good Honours degree from a British university in computer engineering, computer science with a knowledge of computer hardware, or in electronic engineering with some programming experience. Relevant work experience will be taken into account. An IELTS score of 6.5 or equivalent will normally be required from applicants whose first language is not English, or who have not studied their secondary and bachelor's degree education in English.

MSc Embedded Systems:
Qualifications equivalent to a good Honours degree from a British university in computer engineering, computer science with a knowledge of computer hardware, or in electronic engineering with some programming experience. Relevant work experience will be taken into account. An IELTS score of 6.5 or equivalent will normally be required from applicants whose first language is not English, or who have not studied their secondary and bachelor's degree education in English.

MSc Microelectronic System Design:
Qualifications equivalent to a good Honours degree from a British university in electronic engineering or a good Honours degree in computer science, mathematics or other technological subject with a knowledge of mathematics and digital systems. Relevant work experience will be taken into account. An IELTS score of 6.5 or equivalent will normally be required from applicants whose first language is not English, or who have not studied their secondary and bachelor's degree education in English.

MSc Mobile, Wireless and Broadband Communications:
Qualifications equivalent to a good Honours degree from a British university in electronic engineering or a good Honours degree in computer science, mathematics or other technological subject with a knowledge of mathematics and signal processing. Relevant work experience will be taken into account. An IELTS score of 6.5 or equivalent will normally be required from applicants whose first language is not English, or who have not studied their secondary and bachelor's degree education in English.

Aims of the Courses

Generic:
The overall aim of these MSc courses is to provide an enriching learning experience, enhancing the knowledge and skill base of the participating students in the areas of electronic, network and computer engineering. They are intended both for engineers in current practice and for fresh honours graduates to facilitate their professional development, mobility and employability.

More specifically, the generic aims of the courses are to:

G1. Encourage a lively investigative spirit that will sustain a commitment to independent future study.

G2. Provide communication skills associated with oral and written presentations of technical work and develop interpersonal and organisational skills associated with project planning, execution and appraisal.

G3. Provide individualised experience of a significant individual project which exploits and applies disparate modules of knowledge.

G4. Foster a spirit of independent student-centred study with effective management of time and development of research methods.

MSc Computer Networks:
In addition, the MSc in Computer Networks aims to produce postgraduates with an advanced understanding of networks of computers including both the physical and software aspects of such interconnection with hands-on experience of the planning, implementation and maintenance of such systems.

In particular, the course aims to:

N1. Update and extend the students' knowledge and capabilities in the integration and use of interconnected computer systems.

N2. Produce Masters graduates possessing awareness, knowledge and practical skills in these fields by equipping them with advanced critical and evaluative disciplines coupled with analytical and creative problem solving abilities.

N3. Provide students with an advanced understanding of the assembly and interconnection of coherent groups of computer-based equipment into the networks and distributed computing systems that are needed in industry and commerce for many applications.

N4. Develop the students' ability to design, plan and implement such systems.

N5. Furnish students with a range of optional topics which permit pursuit of interests in assessing network performance, mastering additional topics in network security, or in the related fields of wireless communication networks, embedded computer systems, and DSP.

MSc Embedded Systems:
In addition, the MSc in Embedded Systems aims to produce postgraduates with an advanced understanding of real-time embedded systems used for time-critical, resource-intensive applications and the professional engineering skills required to design and implement such systems.

In particular, the course aims to:

E1. Teach advanced system level design, documentation and implementation approaches and provide practical experience in the development and prototyping of embedded computer systems using innovative product design methodologies, platforms and tools.

E2. Provide a firsthand experience in implementing stand-alone micro-controller applications and the use of specialist processors.

E3. Develop the ability to evaluate and exploit the physical capabilities, limitations, cost and application of bus interface protocols, memory devices, hardware devices and processor architectures to produce cutting edge cost effective solutions.

E4. Develop the ability to critically analyse, select and efficiently implement algorithmic solutions for media applications and other general purpose signal processing applications.

E5. Develop the ability to formulate, establish requirements, document and design time critical real-time systems and employ existing and emerging real-time operating systems (RTOS), design methods, languages and development tools to implement these systems.

E6. Furnish exposure to the multidisciplinary nature of embedded systems by using media applications as an example and providing further advanced options in

DSP, custom IC design and communications.

MSc Microelectronic System Design:
In addition, the MSc in Microelectronic System Design aims to produce postgraduates with an advanced understanding of the various routes to implementing systems-on-chip (SoC) and with hands-on experience of the design of such systems using several approaches to their implementation.

In particular, the course aims to:

M1. Produce students who are "silicon qualified" by providing them with a complete SoC design experience.

M2. Establish proficiency in custom integrated circuit design at various levels of system hierarchy including realisation of algorithmic specifications, behavioural modelling, logic synthesis, digital design, transistor-level design and layout-level design.

M3. Provide experience in the use of industry-standard Computer-Aided-Engineering (CAE) software tools for the fast and accurate design, simulation and verification of integrated circuits.

M4. Promote an awareness of, and competence in dealing with, the issues specific to VLSI system design; in particular, issues of testability and complexity management.

M5. Introduce an armoury of possible architectural solutions to particular system requirements especially in applications requiring very high computational efficiency such as DSP.

M6. Furnish students with a range of optional topics which permit pursuit of interests in implementation of processing structures, or in the related fields of embedded computer systems, DSP and communication systems.

MSc Mobile, Wireless and Broadband Communications:
In addition, the MSc in Mobile, Wireless and Broadband Communications aims to produce postgraduates with an advanced understanding of communication systems with special emphasis on cellular and broadband wireless networks as well as the wired networks supporting the wireless infrastructure with hands-on experience of the planning, implementation and maintenance of such systems.

In particular, the course aims to:

C1. Update and extend the students' knowledge and capabilities in wireless and wired communication systems and their standards.

C2. Enhance, to an advanced level, students' understanding of the theoretical principles underpinning digital communication systems.

C3. Promote competence in dealing with the issues specific to the design of communications systems.

C4. Develop an understanding of the problems and challenges associated with the implementation of both fixed and mobile wireless communication systems.

C5. Introduce an armoury of possible solutions to particular communication system requirements.

C6. Furnish students with a range of optional topics which permit pursuit of interest in wireless sub-systems, computer networking, and in the underlying DSP, embedded system and SoC technologies.

Employment and Further Study Opportunities

MSc Computer Networks:

The unprecedented growth exhibited in the commercial and information management uses of the Internet and World Wide Web is really only the visible tip of the vast scientific, computing, technical and engineering developments that are occurring in the field. It is certain that as a result of this growth new computer science and engineering disciplines must emerge. The new programming techniques and technological requirements of this rapidly developing field are *terra incognita* not only to many incumbents who are currently employed in the field but elude even many recent computer science graduates. There is now a long-term and growing market for professionals possessing a clear overview of current information and communication networks capabilities, standards and trends along with a firm grasp of specifics in areas ranging from data network protocols to network security issues.

Whatever developments occur there will always be a need for the designer and engineer who is has knowledge and experience both of the engineering and implementation of a distributed or network system and able to work at the higher levels of abstraction and programming of networked and distributed computing in both development and application. Graduates of the MSc in Computer Networks will have the knowledge and skills to work in this rapidly developing field.

MSc Embedded Systems:

The demand for Embedded System Engineers in all areas of engineering is currently flourishing and is expected to improve, as embedded systems find yet more applications in everyday life. All electronic and software products are now embedded systems. Already there are many examples of embedded systems including digital cameras, media players, ATM machines and robotic surveillance tools. These applications require a high level of skill in hardware and software engineering and an understanding of the practical realities of real systems. They also require knowledge in specialist subjects including Digital Signal Processing (DSP), communications, mechatronics and requirements engineering. The course will equip the student with the key skills required for modern embedded systems including real-time operating systems and microcontrollers. It will also provide knowledge and practical experience of media processors and the opportunity to study specialised option modules.

There are many companies that require engineers that have good software and hardware skills. This has increased tremendously over the past few years as electronics, communications, and media (including television, radio and still image) systems have converged. Despite the high demand for engineers that are competent in both hardware and software disciplines currently there is a short supply of good embedded system engineers as most UK undergraduate programmes currently do not produce such people.

It is expected that the following industries will recruit students from this course: broadcasting, multi-media, internet, science, instrumentation, robotics, surveillance, medical and communications. This list is not exhaustive.

MSc Microelectronic System Design:

The breathtaking advances in the field of microelectronics in the past twenty years has made the implementations and realizations of real-time fast and power efficient computer systems, DSP systems, communication systems, biomedical systems and systems for consumer goods a reality. Contrary to common belief the advancements in silicon processing and geometry reduction continues to move forward and is set to do so for many years to come. Circuit complexities of millions of transistors are

nowadays common place. In order to be able to take full advantage of these advancements in the microelectronic technology suitably qualified engineers with experience and know-how of the latest technological developments, and tools to support them will always be needed.

It is the goal of this MSc course to furnish competent manpower fully capable of making a worthy contribution in this exciting field. Despite the problems in the world economy therefore, the future prospects for employment in the VLSI and microelectronic industry remains optimistic, and the postgraduates of this course are well placed to take advantage of this situation.

This course sets out to provide just such a breadth of view and to simultaneously press home experience of implementation details via suitably selected real-life problem-solving, project and simulation work. All the technical content of the course is delivered with regard to industrial practice benefiting from the teaching teams' experiences with cutting edge industrial research and development work they undertake. The Modules syllabi and contents have been designed to represent 'the-state-of-the-art' in this area, and are fortified by (where appropriate) inviting top experts from industry & academia to teach as external lecturers on the short course. Understanding of the importance of working to standards and stringent design rules, keeping to strict deadlines, formal referencing and acknowledgement of sources of information are emphasised during this course, which will no doubt help the students during their industrial career. While most engineering and technology postgraduates gain employment with large companies, a significant number join small companies or even start up their own business. In this respect, the skills acquired during the course modules and the subsequent viva voce defence of their ILPs proved to be most valuable to most students.

MSc Mobile, Wireless and Broadband Communications:

The demand for engineers in both wide-area and local-area communication networks is currently flourishing and is expected to improve, as multimedia data transmissions find more applications in everyday life. Europe, along with the rest of the world, is currently experiencing unprecedented activity in mobile cellular and local-area communications. The latest communications standards have been hugely influential in accelerating dissemination of mobile telephony, computing and conferencing. They have achieved truly compatible international communications for everyone from roving business personnel to tourists. Everywhere, from the startling expansion of commerce on the World Wide Web to the wireless workplace, society is displaying a voracious appetite for communications on a scale that surpasses even the most optimistic projections of a few short years ago.

The expansion of communications companies is, of course, prodigious. While most of the headlines go to Media Moguls and mergers of gigantic corporate entities, there is a strong upsurge of SMEs (Small and Medium Enterprises) devoted to niche products and services to fuel the communications machine. This has led to a colossal demand for engineers skilled in communications areas and has shaped this MSc course. There is now a long-term and growing market for graduates possessing a clear overview of current communications capabilities, standards and trends. This course sets out to provide just such a breadth of view and to simultaneously press home experience of implementation details via suitably selected problem-solving, project and simulation work.

Learning Outcomes

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

General Learning Outcomes

Graduates will satisfy the following criteria:

G1 **Knowledge and Understanding:** they will be able to demonstrate their knowledge and understanding of essential facts, concepts, theories and principles pertaining to their area of engineering, and its underpinning science and mathematics. They will appreciate the social, environmental, ethical, economic and commercial considerations affecting the exercise of their engineering judgement.

G2 **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.

G3 **Practical Skills:** they will possess practical engineering skills acquired through, for example, work carried out in laboratories; in project work; in design work; and in the use of computer software in design and analysis.

G4 **General Transferable Skills:** they will have developed transferable skills that will be of value in a wide range of situations. These skills include:

- The ability to communicate effectively through written reports and presentations and the ability to handle competently technical questioning.
- The ability to use effectively general IT and information retrieval facilities.
- The ability to develop, monitor and update a plan, to reflect a changing operating environment.
- The ability to monitor and adjust a personal programme of work on an on-going basis, and to learn independently;
- The ability to learn new theories, concepts, methods, etc and apply these to solve problems in unfamiliar situations.

Specific Learning Outcomes

1. Underpinning Science and Mathematics

MSc Computer Networks

Graduates will be able to demonstrate:

US1m A comprehensive understanding of the scientific principles of communication networks and related disciplines;

US2m An awareness of developing technologies related to computer networks;

US3m A comprehensive knowledge and understanding of mathematical and computer models relevant to network communications and performance, and an appreciation of their limitations;

US4m An understanding of concepts from a range of areas including some outside computer networks engineering, and the ability to apply them effectively in engineering projects.

MSc Embedded Systems

Graduates will be able to demonstrate:

US1m A comprehensive understanding of the scientific principles of embedded systems and related disciplines;

US2m An awareness of developing technologies related to embedded systems;

US3m A comprehensive knowledge and understanding of mathematical and computer models relevant to algorithmic implementation in embedded systems and system performance, and an appreciation of their limitations;

US4m An understanding of concepts from a range of areas including some outside embedded systems engineering, and the ability to apply them effectively in engineering projects.

MSc Microelectronic System Design

Graduates will be able to demonstrate:

US1m A comprehensive understanding of the scientific principles of microelectronic systems and related disciplines;

US2m An awareness of developing technologies related to microelectronics and SoC design methodologies;

US3m A comprehensive knowledge and understanding of mathematical and computer models relevant to algorithmic implementation in microelectronic systems and system performance, and an appreciation of their limitations;

US4m An understanding of concepts from a range of areas including some outside microelectronic system design engineering, and the ability to apply them effectively in engineering projects.

MSc Mobile, Wireless and Broadband Communications

Graduates will be able to demonstrate:

US1m A comprehensive understanding of the scientific principles of mobile, wireless and broadband communications and related disciplines;

US2m An awareness of developing technologies related to communication networks;

US3m A comprehensive knowledge and understanding of mathematical and computer models relevant to digital transmission and communication performance and planning, and an appreciation of their limitations;

US4m An understanding of concepts from a range of areas including some outside communications engineering, and the ability to apply them effectively in engineering projects.

2. Engineering Analysis

MSc Computer Networks

Graduates will be able to demonstrate:

E1m Ability to use fundamental knowledge to investigate new and emerging technologies impacting computer networks and digital

communications;

E2m Ability to apply mathematical and computer-based models for solving networking and distributed computing problems, and the ability to assess the limitations of particular cases;

E3m Ability to extract data pertinent to an unfamiliar problem, and apply in its solution using computer based engineering tools when appropriate.

MSc Embedded Systems

Graduates will be able to demonstrate:

E1m Ability to use fundamental knowledge to investigate new and emerging technologies impacting embedded systems;

E2m Ability to apply mathematical and computer-based models for solving problems associated with embedded systems implementations, and the ability to assess the limitations of particular cases;

E3m Ability to extract data pertinent to an unfamiliar problem, and apply in its solution using computer based engineering tools when appropriate.

MSc Microelectronic System Design

Graduates will be able to demonstrate:

E1m Ability to use fundamental knowledge to investigate new and emerging technologies impacting microelectronics and SoC design;

E2m Ability to apply mathematical and computer-based models for solving problems associated with SoC implementations, and the ability to assess the limitations of particular cases;

E3m Ability to extract data pertinent to an unfamiliar problem, and apply in its solution using computer based engineering tools when appropriate.

MSc Mobile, Wireless and Broadband Communications

Graduates will be able to demonstrate:

E1m Ability to use fundamental knowledge to investigate new and emerging technologies impacting digital communication networks;

E2m Ability to apply mathematical and computer-based models for solving problems associated with digital transmission and communication networks, and the ability to assess the limitations of particular cases;

E3m Ability to extract data pertinent to an unfamiliar problem, and apply in its solution using computer based engineering tools when appropriate.

3. Design

All MSc degrees

Graduates will be able to demonstrate:

D1m Wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations;

D2m Ability to generate an innovative design for products, systems, components or processes to fulfil new needs.

4. Economic, Social, and Environmental Context

All MSc degrees

Graduates will be able to demonstrate:

S5 Understanding of the need for a high level of professional and ethical conduct in engineering.

5. Engineering Practice

All MSc degrees

Graduates will be able to demonstrate:

P1m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments;

P2m Extensive knowledge and understanding of a wide range of design techniques and applicable technologies;

P3m Ability to apply engineering techniques taking account of a range of commercial and industrial constraints.

Teaching, Learning and Assessment Methods

The taught portion of the courses is done in highly concentrated short courses within the six core modules, so that the student rapidly gains a full overview of the horizons of the subject matter and comes to a state of relevant functionality without a great deal of elapsed time. This can be especially important if the student is attending on an occasional basis, and has urgent needs of immediate skill in the study topic in his/her place of work. It is in the style of short courses assembled by this Course Team to provide adequate time for “hands-on” practice of concepts, interspersed with one-hour lecture sessions. Utilisation exercises occur close to lectures in order to press home the taught material before covering too much ground. Throughout the week-long short course, the participant usually experiences practical in-place application of the knowledge being dispensed on most days of the short course instruction, and has abundant “soak time” and re-enforcement through practice of techniques in performance of Independent Learning Package (ILP) tasks during the periods between the short courses.

Assignments and exercises carried out in the short course component of a Learning Module are meant to develop basic capability and, as such, serve as a useful vehicle for sharpening the skills baseline for undertaking the associated ILP – often through keen competition within the class. Assignments within the short courses are not explicitly subject to assessment, whereas ILPs are.

Course Structure

This section shows the core and option modules available as part of the course and their credit value. Full-time Postgraduate students study 180 credits in the academic year. Part time students will normally complete the 180 credits in two or three academic years.

Overall Structure:

Each MSc course consists of six learning modules (20 credits each) plus an individual project (60 credits).

When taken in full-time mode, the course is completed in one calendar year.

When taken in part-time mode, the course can be completed in two or three years. Typical two-year and three-year study patterns are:

Course Length	Two-Year	Three-Year
Year 1	4 Learning Modules	3 Learning Modules
Year 2	2 Learning Modules + Project	3 Learning Modules
Year 3	--	Project

Course Modules:

MSc Computer Networks			
Core/ Option	Module Code	Module Title	Credits
Core	EECN700	Communication and Computer Networks	20
Core	EECN705	Network Programming	20
Core	EECN710	Network Configuration and Operation	20
Option	EECN750	Network Security	20
Option	EECN755	Distributed Systems	20
Option	EECN760	Network Modelling and Simulation	20
Option	-	Any module in MSc Mobile, Wireless and Broadband Communications, MSc Embedded Systems and MSc Microelectronic System Design	20 each
Core	ENCE798	Project Part I	20
Core	ENCE799	Project Part II	40

MSc Embedded Systems			
Core/ Option	Module Code	Module Title	Credits
Core	EEES700	Embedded System Design	20
Core	EESD700	Integrated Digital System Design	20
Core	EEES705	Real-Time Environments	20
Option	EEES750	Video and Image Processing	20
Option	EEES755	Embedded Media Processing	20
Option	-	Any module in MSc Microelectronic System Design, MSc Mobile, Wireless and Broadband Communications and MSc Computer Networks	20 each
Core	ENCE798	Project Part I	20
Core	ENCE799	Project Part II	40

MSc Microelectronic System Design			
Core/ Option	Module Code	Module Title	Credits
Core	EESD700	Integrated Digital System Design	20
Core	EESD705	Microelectronic Circuit Design	20
Core	EESD710	SoC and FPGA Design Project	20
Option	EESD750	DSP and Communication Processor Design	20
Option	-	Any module in MSc Embedded Systems, MSc Mobile, Wireless and Broadband Communications and MSc Computer Networks	20 each
Core	ENCE798	Project Part I	20
Core	ENCE799	Project Part II	40

MSc Mobile, Wireless and Broadband Communications			
Core/ Option	Module Code	Module Title	Credits
Core	EEMB700	Communication Principles	20
Core	EECN700	Communication and Computer Networks	20
Core	EEMB705	Broadband Wireless Networks	20
Option	EEMB710	Cellular Wireless Networks	20
Option	EEMB750	Wireless System Design	20
Option	EEMB755	DSP Design and Applications	20
Option	EEMB760	Multirate Signal Processing	20
Option	-	Any module in MSc Computer Networks, MSc Embedded Systems and MSc Microelectronic System Design	20 each
Core	ENCE798	Project Part I	20
Core	ENCE799	Project Part II	40

NB1: All modules are at Credit Level 7.
NB2: Not all option modules will necessarily be offered in any one year.

Course Regulations

The assessment procedures of these courses shall be conducted according to the Assessment Regulations of the University of Westminster other than when overridden by the course-specific regulations given here. Credit awards of other institutions will not, by automatic right, be honoured by the University towards the requirements of these courses; any applicant seeking exemption by Accreditation of Prior Learning (APL) will be required to follow the University's APL procedures.

Note that the core and option modules of each course are defined in the respective course structure tables above.

Assessment of Learning Modules

Assignments and exercises carried out in the short course component of a Learning Module are meant to develop basic capability and, as such, serve as a useful vehicle for sharpening the skills baseline for undertaking the associated Independent Learning Package (ILP) – often through keen competition within the class. Short courses are not explicitly subject to assessment, whereas ILPs are.

Assessment is carried out when the student presents himself/herself for examination. This process has two phases: submission of all supporting written evidence (worked problems, design and simulation results, software programs, written reports and the like), followed by attendance for an oral defence of the work of the ILP. An ILP

Review Panel, consisting of at least two members of staff, will be empowered to render the pass/fail judgement after thorough scrutiny of the written evidence and hearing the oral defence and to make a recommendation to the Assessment Board.

It will be the principal task of the panel to assess the student's competence through carrying out the assigned work, with respect to the norms of professional-level competence which pertain to that subject. The result is a pass/fail judgement. Students must achieve a pass to be awarded the credits for that module. Specifically the criteria used for assessment are the learning outcomes of each Learning Module. In order to pass a module:

1. The student must demonstrate achievement in **each** and **every** learning outcome either through the written ILP submission or during the viva voce examination;

2. The majority of the required ILP work must be completed satisfactorily as viewed through the written submission;

3. The majority of the candidate's responses in the examination must be correct;

4. The viva voce examination must verify that the student has ownership of the ILP material and is able to defend it orally.

The major purposes of the viva voce examination are to:

- verify that the student has ownership of the written submission;
- clarify the student's degree of subject authority in areas where this has not been established through the written submission;
- explore the student's mental flexibility in applying advanced levels of technical knowledge to new applications;
- probe the student's depth of understanding and capacity for higher level critical analysis;
- allow the student to demonstrate interactive communication skills.

Failure to submit the written material by the deadline agreed by the student or absence from the viva voce examination, without reasonable cause supported by evidence submitted in accordance with the University's special circumstances procedures, will be considered a failure of the module. Therefore, a subsequent late submission or attendance at a re-scheduled oral examination would constitute a re-assessment. Students experiencing difficulties should contact their Personal Tutor, the Module Leader or the Course Leader for advice, well before the deadline.

If the candidate has passed the module at the first attempt and is not being reassessed, and the candidate's submitted ILP work and performance during the examination are deemed to be meritorious, the panel will flag the pass as being "With Merit". This is exemplified by:

1. the student demonstrating subject authority with reasonable confidence and fluency;
2. a virtually complete written submission, on time, with few mistakes;
3. little or no help required in handling technical questioning during the oral examination;
4. the ability to conceptualise and critically evaluate their subject matter.

If the candidate has passed the module at the first attempt and is not being reassessed, and the candidate's submitted ILP work and performance during the examination are deemed to be outstanding, the panel will flag the pass as being "With Distinction". This is exemplified by:

1. the student demonstrating a complete subject authority with confidence and fluency;
2. a virtually complete written submission, on time, with no significant mistakes;
3. little or no help required in handling technical questioning during the oral examination;
4. the ability to conceptualise and critically evaluate their subject matter at a high level;
5. the student showing evidence of being able to extend and apply the taught material to new situations with alacrity.

The panel may make a recommendation of 'Pass', 'Pass with Merit' or 'Pass with Distinction' conditional upon minor modifications to the submitted ILP work being completed.

Project Assessment

Completion of the Individual Project is signalled by submission of the Project thesis for assessment. A Project Review Panel receives an oral defence of the project work and, incorporating its assessment of the thesis, decides upon credit award. Again, this is a pass/fail decision.

Failure to submit the thesis by the deadline agreed by the student or absence from the viva voce examination, without reasonable cause supported by evidence submitted in accordance with the University's special circumstances procedures, would be considered a failure of the module. Therefore, a subsequent late submission or attendance at a re-scheduled oral examination will constitute a re-assessment. Students experiencing difficulties should contact their Supervisor, their Personal Tutor the Project Co-ordinator or the Course Leader for advice, well before the deadline. For further details, please refer to Section 6 of the Framework for Postgraduate Courses published in the University Essential Information Guide.

If the candidate has passed the Project at the first attempt and is not being reassessed, and the candidate's project thesis and performance during the examination are judged meritorious, the panel will flag the pass as being "With Merit". This would be exemplified by:

1. a significant amount of independent work undertaken during the project period;
2. the student demonstrating subject authority with reasonable confidence and fluency;
3. the ability to critically evaluate the work undertaken;
4. good written skills in terms of drafting and self-editing;
5. a thesis submitted on time, with few mistakes;
6. little or no help required in handling technical questioning during the oral examination.

If the candidate has passed the Project at the first attempt and is not being reassessed, and the candidate's project thesis and performance during the examination are judged outstanding, the panel will flag the pass as being "With Distinction". This would be exemplified by:

1. a substantial amount of independent work undertaken during the project period;
2. the candidate demonstrating a complete subject authority with confidence and fluency;
3. the ability to conceptualise and critically evaluate the work undertaken at a high level;
4. excellent written skills in terms of drafting and self-editing;
5. a thesis submitted on time, with no significant mistakes;
6. little or no help required in handling technical questioning during the oral examination;
7. evidence of the student extending the original scope of the project.

A structured procedure will be employed in grading both the thesis and performance during the oral presentation. There will be at least three members on a Project Review Panel: Supervisor, Assessor and Moderator. The Project Supervisor has greatest familiarity with the topic and the volume, depth and quality of the student's work. The Assessor, like the Supervisor, will have studied the thesis prior to the presentation. By contrast, the Moderator judges solely on the quality and accuracy of the oral presentation and the candidate's ability to conduct a credible defence during questioning. The Moderator, who is present at a significant number of project viva voce examinations, has the additional responsibility to adjudicate and harmonise the panel's findings with those resulting from other Project presentations. Following the examinations, the Moderators meet as a panel to finalise the harmonisation of results across the cohort and to resolve any borderline cases.

As with the learning modules, the learning outcomes of the Project form the basis of the assessment criteria. No explicit weighting is placed on the written report and on the viva voce examination. The two forms of assessment collectively ensure that the learning outcomes of the Project are achieved for it to be passed. However, the viva voce examination has certain specific functions which include:

- the opportunity for the student to demonstrate presentation and interactive communication skills;
- verification that the project is the student's own work;
- clarification of the student's degree of subject authority in areas where this has not been established within the report;
- probing the student's depth of understanding of the project;
- exploring the student's mental flexibility in extending the reported project work to new areas.

Penalties for Late Submission of Coursework

The University operates a two-tier penalty system for late submission of ILP and project reports. This regulation applies to all students registered for an award, irrespective of their level of study. All University coursework deadlines are scheduled between Monday and Thursday inclusive.

If the report is submitted within 24 hours of the deadline, a Distinction grade cannot be awarded and a Merit grade cannot be awarded unless the work was, in fact, of Distinction quality. If the report is submitted more than 24 hours or more than one working day after the specified deadline you will be given a grade of 'fail' for the work in question.

Late work and any claim of mitigating circumstances relating to coursework must be submitted at the earliest opportunity to ensure as far as possible that the work can still be marked. Late work will not normally be accepted if it is received more than five working days after the original coursework deadline. Once the work of other students has been marked and returned, late submissions of that same piece of work cannot be assessed.

Reassessment of Learning Modules and the Project

Normally, no student shall be permitted to attempt a Learning Module more than twice other than when sanctioned by the Mitigated Circumstances Board. The Project can only be *assessed* twice other than when sanctioned by the Mitigated Circumstances Board. Following failure of the first assessment of the project, the student may either be reassessed or to retake the Project in entirety at the discretion of the Assessment Board. The Project cannot be retaken following reassessment nor can a second attempt be reassessed.

Reassessment may take the form of:

a re-submission of all or part of the ILP written submission or project report;

OR a repeat viva voce examination;

OR both.

The award of credits with Merit or Distinction cannot be made following reassessment.

The Assessment Boards

Wherever possible, there will be a joint combined Subject and Conferment Board for the following courses:

- Computer Networks;
- Embedded Systems;
- Microelectronic System Design;
- Mobile, Wireless and Broadband Communications

The role of the Subject/Conferment Board is to confirm the recommendations of the ILP and Project Review Panels in the award of credits for modules passed and to recommend the award of MSc, PgDip and PgCert and whether these awards should be conferred with Merit or Distinction.

The Mitigating Circumstances Board will take into account any mitigating circumstances, submitted by the student, which may have affected the student's performance in one or more modules. Where the Mitigating Circumstances Board is satisfied that the mitigating circumstances affected the student's performance in that module assessment, it will recommend to the Subject/Conferment Board to compensate for the mitigating circumstances if the student has marginally failed or to allow deferred assessment.

The Subject/Conferment Board may make Aegrotat awards in accordance with the Assessment Regulations of the University.

Role of the External Examiners

A panel of typically three External Examiners shall be appointed to these courses in accordance with the regulations of the University. The expertise of the panel should collectively span the subject areas of the courses being considered. The principal roles of the External Examiners are to oversee and certify:

1. the academic standards and advise on the operation of the core and option Learning Modules;
2. the individual projects of students;
3. the operation of the assessment boards and the overall standard of the awards.

The External Examiners will have access to all matters pertinent to the courses, including ILP reports of assessment retained by the Module Leaders. However – in view of the multitude of asynchronous milestones being completed by various students – it will not generally be practical to consult on anything other than a macroscopic, retrospective basis.

It is standard practice to video record all viva voce examinations and to archive these tapes for at least one year. In this way, the External Examiners will be able to reconstruct and evaluate all factors which have contributed to any individual student's assessment, thereby having unimpeded oversight of every aspect of course operation.

The duties of the External Examiners will include:

- sampling of ILP assignments to ensure the calibre of their content and the standard of the work carried out by the students;
- sampling of project theses to ensure that a postgraduate standard is being maintained;
- viewing samples of video records of viva voce examinations for ILPs and projects;
- attending assessment boards;
- providing an annual report to the University on the operation of the course and assessment procedures.

Award of the Postgraduate Certificate

To qualify for the award of a Postgraduate Certificate (PgCert), a student must have been awarded at least 60 credits accruing from the core or option learning modules forming their course or the Project. At least one of these modules must be a core module other than the Project.

These Postgraduate Certificates may be awarded with Merit normally only if the student has accrued at least 40 credits with Merit or 20 credits with Distinction.

These Postgraduate Certificates may be awarded with Distinction normally only if the student has accrued at least 40 credits with Distinction and 20 credits with Merit.

A student registered for the Diploma or MSc award may elect to submit his/her credits for the award of a Postgraduate Certificate but, by so doing, relinquishes the right to submit those credits for the award of an MSc or PgDip at a later date.

Award of the Postgraduate Diploma

To qualify for the award of a Postgraduate Diploma (PgDip), a student must have been awarded at least 120 credits accruing from the core or option learning modules forming their course or the Project. If the Project is included, normally at least two of these modules must be a core module other than the Project. Otherwise, normally at least three of these modules must be a core module other than the Project.

These Postgraduate Diplomas may be awarded with Merit normally only if the student has accrued:

at least 60 credits with Merit and all the credits accrued were obtained by passing the modules at the first attempt without reassessment

or at least 80 credits with Merit

or at least 20 credits with Distinction and 20 credits with Merit and all the credits accrued were obtained by passing the modules at the first attempt without reassessment

or at least 20 credits with Distinction and 40 credits with Merit and at least 20 of the remaining credits accrued were obtained by passing the module at the first attempt without reassessment.

These Postgraduate Diplomas may be awarded with Distinction normally only if the student has accrued:

at least 60 credits with Distinction and 60 credits with Merit

or at least 80 credits with Distinction and 20 credits with Merit and all the credits accrued were obtained by passing the modules at the first attempt without reassessment

or at least 100 credits with Distinction.

A student registered for the MSc award may elect to submit his/her credits for the award of a Postgraduate Diploma but, by so doing, relinquishes the right to submit those credits for the award of an MSc at a later date.

Award of the MSc Degree

To qualify for the award of Master of Science (MSc), a student must have:

(a) been awarded at least 180 credits accruing from the Project and six learning modules forming their course. Normally, these will include all the core learning modules in their course; and

(b) Attempted modules worth no more than 240 credits (under this regulation, a first attempt of any module will count as an attempt, and a re-attempt of any module that a student has failed will count as a further separate attempt. Reassessment following failure at the first attempt will not count as a further separate attempt); and

These MSc Degrees may be awarded with Merit normally if:

(a) the student has not failed, or had to be re-assessed in, more than one learning module;

(b) and the Individual Project has been passed with Merit;

(c) and the student has accrued at least 100 credits with Merit,
or at least 20 credits with Distinction and 60 credits with Merit;

or at least 60 credits with Distinction.

These MSc Degrees may be awarded with Distinction normally if:

(a) the student has not failed, or had to be re-assessed in, more than one learning module;

(b) and the Individual Project has been passed with Distinction;

(c) and the student has accrued at least 100 credits with Distinction and 80 credits with Merit,
or at least 120 credits with Distinction and 40 credits with Merit;
or at least 140 credits with Distinction.

Statutes of Limitations

Normally, a student is expected to meet the conditions for the award for which the student is registered within the following maximum period of registration

	Full-Time	Part-Time
PgDip	2 years	4 years
PGCert	1 year	2 years
MSc	4 years	5 years

Where a student, having attempted modules worth more than 60 credits, has failed modules worth ***more*** than 1/3 of total credits attempted, or has failed and cannot have a further attempt at a core module, and the Subject/Conferment Board judges that the student will not achieve the next named award to which the student would be eligible within the maximum period of registration, then the board may exclude the student from the programme of study. Alternatively the Board may recommend that the student transfer to the Postgraduate Diploma programme (and consequently not undertake the Individual Project module). Normally, this would not be done if the student has passed at least three learning modules at the first attempt without reassessment.

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 420,000 volumes, 2,500 journal subscriptions and numerous electronic resources including databases, e-journals, CD-ROMs and internet links. There are over 3500 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 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
- IET Handbook of Learning Outcomes for BEng and MEng Programmes, IET December 2008.
- IET Accredited MSc Programmes, IET, December 2009
- Guidelines on Course Accreditation, BCS (British Computer Society), September 2009.
- Guidelines on Compensation, IET, December 2009.

Also:

- EPC (Engineering Professors' Council) The EPC Engineering Graduate Output Standard
- QAA Guidelines for Preparing Programme Specifications
- SEEC Credit Level Descriptors for Further and Higher Education

Quality Management and Enhancement

Course approval, monitoring and review

These courses were approved in their present form by a University Review Panel in 2010. The Panel included internal peers from the University and external subject specialists from academia and industry to ensure the comparability of the course to those offered in other Universities and the relevance to employers. Periodic Course Review helps to ensure that the curriculum is up-to-date and that the skills gained on the course continue to be relevant to employers.

The courses are monitored each year by the School 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 each course. The Campus Academic Standards Group audits this process 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 will be elected to sit on the committee to represent the views of their peer group in 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 will inform the Module Leader on the effectiveness of the module and highlight 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 Campus Academic Standards Group as part of the annual monitoring process.

For more information about these courses:
http://www.westminster.ac.uk/ecs

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 Handbooks which provide more detailed information on the specific learning outcomes.