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Programme Specification

Course record information

Name and level of final award:	MSc Telecommunications with Digital Signal Processing, MSc Telecommunications with Satellite and Broadband Technologies, MSc Telecommunications with Wireless Technologies
Name and level of intermediate awards:	Postgraduate Diploma (PGDip) Telecommunications Postgraduate Certificate (PGCert) Telecommunications
Awarding body/institution:	University of Westminster
Status of awarding body/institution:	Recognised Body
Location of delivery:	Cavendish
Language of delivery and assessment:	English
Course/programme leader:	
Course URL:	
Mode and length of study:	Full-Time (One year) Part-Time (Two years) Part-Time (Three years)
University of Westminster course code:	
JACS code:	H640
UCAS code:	
QAA subject benchmarking group:	Electronic Engineering Computer Science
Professional body accreditation:	IET
Date of course validation/review:	2015
Date of programme specification:	2015

Admissions requirements

MSc Telecommunications with Digital Signal Processing:

Qualifications equivalent to a good Honours degree (i.e. minimum a good 2:2) 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.

MSc Telecommunications with Satellite and Broadband Technologies:

Qualifications equivalent to a good Honours degree (i.e. minimum a good 2:2) 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. 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 Telecommunications with Wireless Technologies:

Qualifications equivalent to a good Honours degree (i.e. minimum a good 2:2) 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. 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

The overall aim of the telecommunications suite of MSc courses is to provide an enriching learning experience, enhancing the knowledge and skill base of the participating students in the area of telecommunications. The courses are intended both for engineers in current practice and for fresh honours graduates to facilitate their professional development, mobility and employability.

In more detail, 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;
G5 Provide a broad coverage of engineering topics that includes not only technical design issues but also a wider set of considerations including social and economic, ethical and environmental issues;
G6 Develop teamwork skills by providing a framework of group activities.

Further Details Relating to the Three Individual MSc Pathways

Aims Specific to the
MSc Telecommunications with Digital Signal Processing

The MSc in Telecommunications with Digital Signal Processing (DSP) aims to produce postgraduates with an advanced understanding of communication systems with special emphasis on the application of DSP, which supports and pervades all modern communication systems.

In particular, this course pathway aims to:

TSP1 update and extend the students' knowledge and capabilities in wireless and wired communication systems and their standards.

TSP2 enhance, to an advanced level, students' understanding of the theoretical principles underpinning digital signal processing and how it enables digital communication systems to be realised.

TSP3 promote competence in dealing with the issues specific to the design of communications systems.

TSP4 develop an understanding of the problems and challenges associated with the implementation of both fixed and mobile wireless communication systems.

TSP5 foster the ability to design and build digital filters to perform signal shaping and for use as matched filters in white noise and in pole-only noise.

TSP6 develop the ability to analyse and implement key DSP transmission, reception and detection algorithms used in modern-day telecommunications.

Aims Specific to the
MSc Telecommunications with Satellite and Broadband Technologies

The MSc in Telecommunications with Satellite and Broadband Technologies aims to produce postgraduates with an advanced understanding of communication systems utilising satellite and broadband elements.

In particular, the course aims to:

TSB1 update and extend the students' knowledge and capabilities in wireless and wired communication systems and their standards;

TSB2 enhance, to an advanced level, students' understanding of the theoretical principles underpinning digital communication systems;

TSB3 promote competence in dealing with the issues specific to the design of communications systems;

TSB4 develop an understanding of the problems and challenges associated with the implementation of both fixed and mobile wireless communication systems;

TSB5 foster the ability to analyse leading edge satellite and broadband systems utilising modern architectures with the aim of providing new services;

TSB6 develop the ability to analyse broadband systems with the aim of designing and defining methodologies for improving performance, service quality and management.

Aims Specific to the
MSc Telecommunications with Wireless Technologies

The MSc in Telecommunications with Wireless Technologies aims to produce postgraduates with an advanced understanding of communication systems with a focus on wireless technologies.

In particular, the course aims to:

TWT1 update and extend the students' knowledge and capabilities in wireless and wired communication systems and their standards;

TWT2 enhance, to an advanced level, students' understanding of the theoretical principles underpinning digital and analog communication systems;

TWT3 promote competence in dealing with the issues specific to the design of communication systems;

TWT4 develop an understanding of the problems and challenges associated with the implementation of both fixed and mobile wireless communication systems;

TWT5 foster the ability to analyse, design and build RF and microwave systems for wireless communication systems;

TWT6 develop the ability to model the behaviour of wireless systems from circuits, filters and antenna design to the implementation of communication techniques.

Employment and further study opportunities

Today's organisations need graduates with both good degrees and skills relevant to the workplace, i.e. employability skills. The University of Westminster is committed to developing employable graduates by ensuring that:

- career development skills are embedded in all courses
- opportunities for part-time work, placements and work-related learning activities are widely available to students
- staff continue to widen and strengthen the University's links with employers in all sectors, involving them in curriculum design and encouraging their participation in other aspects of the University's career education and guidance provision
- staff are provided with up-to-date data on labour market trends and employers' requirements, which will inform the service delivered to students.

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 these MSc courses. There is now a long-term and growing market for graduates possessing a clear overview of current communications capabilities, standards and trends. The three courses comprising the telecommunications suite of MSc pathways described here set 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.

Successful graduates are likely to go into one of the following roles:

- Telecommunication engineer
- Electronic systems design engineer
- Robotic systems design engineer
- Embedded systems design engineer
- Measurements and instrumentation engineer
- Medical electronic design engineer
- Control systems engineer
- Computer systems engineer
- Software engineer

In various industries such as:

- Telecommunication industry
- Electronic systems industry
- Medical equipment manufacturers
- Instrumentation industry
- Transport industries
- Automobile industry
- Aviation industry
- Consumer industry
- Security and surveillance industry

Learning Outcomes

General Learning Outcomes

Knowledge and understanding

Graduates will satisfy the following criteria:

GSa 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.

Specific Skills

GSb 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.

GSc 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.

Key transferable skills

GSd They will have developed transferable skills that will be of value in a wide range of situations. These skills include:

- the ability to exercise initiative and personal responsibility whilst working with others;
- the ability to plan self-learning and improve performance, as the foundation for lifelong learning;
- 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. Science and Mathematics

MSc Telecommunications with Digital Signal Processing

Graduates will be able to demonstrate:

SM1fl a comprehensive understanding of the scientific principles of telecommunications and those of Digital Signal Processing (DSP), including discrete-time system characterisation, various transforms for discrete-time signals, spectral analysis,

digital filter design, signal detection and stochastic signal representation and handling;

SM2fl a critical awareness of current problems and innovations relevant to DSP with the use of mathematical and computer models; digital transmission and communication performance and planning, and an appreciation of communication system capabilities;

SM3fl understanding of developing technologies and concepts related to DSP and communications from a range of areas including some outside communications engineering, and the ability to apply them effectively in engineering projects.

MSc Telecommunications with Satellite and Broadband Technologies

Graduates will be able to demonstrate:

SM1fl a comprehensive understanding of the scientific principles of satellite and broadband systems for telecommunications, including practical link budgets, parameters of mobile fading channels and various elements affecting reliability of operation;

SM2fl a critical awareness of current problems and innovations in the area of satellite and broadband technologies with the use of mathematical and computer models; digital transmission and satellite communication performance and planning, and an appreciation of broadband and satellite communication system capabilities;

SM3fl understanding of developing technologies and concepts related to satellite and broadband from a range of areas including some outside communications engineering, and the ability to apply them effectively in engineering projects.

MSc Telecommunications with Wireless Technologies

Graduates will be able to demonstrate:

SM1fl a comprehensive understanding of the scientific principles of wireless systems, including path loss and fading phenomena, and evaluating user requirements for 4G and 5G mobile systems;

SM2fl a critical awareness of current problems and innovations in the area of wireless systems with the use of mathematical and computer models; wireless transmission and mobile communication performance and planning, and an appreciation of wireless system capabilities;

SM3fl understanding of developing technologies and concepts related to wireless systems from a range of disciplines including some outside the wireless area, and the ability to apply them effectively in engineering projects.

2. Engineering Analysis

MSc Telecommunications with Digital Signal Processing

Graduates will be able to demonstrate:

EA1fl the ability to employ analytical and modelling tools for solving complex problems in DSP and telecommunications and evaluate the limitations of the modelling environment;

EA2fl the ability to use fundamental knowledge in the area of DSP and apply to new and emerging telecommunication systems;

EA3fl the ability to assess and adapt recent research results in the area of DSP and apply to the solution of unfamiliar problems and incompletely characterised systems;

MSc Telecommunications with Satellite and Broadband Technologies

Graduates will be able to demonstrate:

EA1fl the ability to employ analytical and modelling tools for solving complex problems in satellite and broadband systems and evaluate the limitations of the modelling environment;

EA2fl the ability to use fundamental knowledge in the satellite and broadband area and apply to new and emerging telecommunication systems;

EA3fl the ability to assess and adapt recent research results in the area of satellite and broadband, and apply to the solution of unfamiliar problems and incompletely characterised systems;

MSc Telecommunications with Wireless Technologies

Graduates will be able to demonstrate:

EA1fl the ability to employ analytical and modelling tools for solving complex problems in wireless systems and evaluate the limitations of the modelling environment;

EA2fl the ability to use fundamental knowledge in the area of wireless systems and where appropriate investigate and appraise new and emerging wireless technologies;

EA3fl the ability to assess and adapt recent research results in the wireless area, and apply to the solution of unfamiliar problems and incompletely characterised systems;

3. Design

MSc Telecommunications with Digital Signal Processing

Graduates will be able to demonstrate:

D1fl in-depth knowhow in making design choices with the aid of laboratory experiments and DSP tools in the face of uncertain and incomplete data and quantify these effects on the overall design;

D2fl knowledge and comprehensive understanding of various non-optimal and optimal DSP design solutions and methodologies and their application to unfamiliar scenarios;

D3fl the ability take a complex specification for a DSP and telecommunications scenario and generate a system to fulfil new needs.

MSc Telecommunications with Satellite and Broadband Technologies

Graduates will be able to demonstrate:

D1fl in-depth knowhow in making design choices with the aid of laboratory experiments and tools in the face of uncertain and incomplete satellite and broadband data and quantify these effects on the overall design;

D2fl knowledge and comprehensive understanding of various modern communication system architectures and their application to unfamiliar scenarios;

D3fl the ability take a complex specification for a satellite or broadband application and generate a system to fulfil new needs.

MSc Telecommunications with Wireless Technologies

Graduates will be able to demonstrate:

D1fl in-depth knowhow in making design choices with the aid of laboratory experiments and modern software platforms in the face of uncertain and incomplete information in the wireless area and quantify these effects on the overall design;

D2fl knowledge and comprehensive understanding of various modern wireless system architectures and their application to unfamiliar scenarios;

D3fl the ability take complex specifications for components making up wireless systems and generate a solution to fulfil new needs.

4. Economic, Legal, Social, Ethical and Environmental Context

MSc Telecommunications with Digital Signal Processing

Graduates will be able to demonstrate:

ET1fl the ability to fully articulate the importance of high levels of professional and ethical conduct by analysing a complex design in the area of Telecommunications and DSP; identifying the ethical issues related to the application of the design and its full product cycle.

ET2fl the ability to communicate an objective defence of the chosen design process taking into account commercial risk, codes of practice, safety requirements and the social impact of modern DSP and telecommunication systems;

ET3fl the ability to communicate an objective defence of the chosen business arguments and design process given knowledge of various methodologies, business and management models, quality assurance systems, regulatory practices and certification requirements for DSP and telecommunication systems;

ET4fl the ability to identify required resources and design processes that will ensure sustainable development and longevity in the area of telecommunications and DSP;

ET5fl awareness of relevant regulatory requirements and international compliance standards in the area of telecommunication and DSP systems;

ET6fl the awareness and ability to evaluate risks related to the environment, health and safety and where appropriate commercial risk for a given telecommunications and DSP area.

MSc Telecommunications with Satellite and Broadband Technologies

Graduates will be able to demonstrate:

ET1fl the ability to fully articulate the importance of high levels of professional and ethical conduct by analysing a complex design in the area of satellite and broadband systems; identifying the ethical issues related to the application of the design and its full product cycle.

ET2fl the ability to communicate an objective defence of the chosen design process taking into account commercial risk, codes of practice, safety requirements and the social impact of modern satellite and broadband systems;

ET3fl the ability to communicate an objective defence of the chosen business arguments and design process given knowledge of various methodologies, business and management models, quality assurance systems, regulatory practices and certification requirements for satellite and broadband systems;

ET4fl the ability to identify required resources and design processes that will ensure sustainable development and longevity in the area of satellite and broadband systems;

ET5fl awareness of relevant regulatory requirements and international compliance standards in the area of satellite and broadband systems;

ET6fl the awareness and ability to evaluate risks related to the environment, health and safety and where appropriate commercial risk for a given satellite and broadband system.

MSc Telecommunications with Wireless Technologies

Graduates will be able to demonstrate:

ET1fl the ability to fully articulate the importance of high levels of professional and ethical conduct by analysing a complex design in the area of wireless systems; identifying the ethical issues related to the application of the design and its full product cycle.

ET2fl the ability to communicate an objective defence of the chosen design process taking into account commercial risk, codes of practice, safety requirements and the social impact of modern wireless systems;

ET3fl the ability to communicate an objective defence of the chosen business arguments and design process given knowledge of various methodologies, business and management models, quality assurance systems, regulatory practices and certification requirements for wireless systems;

ET4fl the ability to identify required resources and design processes that will ensure sustainable development and longevity in the area of wireless systems;

ET5fl awareness of relevant regulatory requirements and international compliance standards in the area of wireless systems;

ET6fl the awareness and ability to evaluate risks related to the environment, health and safety and where appropriate commercial risk for a given wireless system.

5. Engineering Practice

MSc Telecommunications with Digital Signal Processing

Graduates will be able to demonstrate:

EP1fl advanced-level knowledge and understanding of high speed DSP algorithms, system identification, compensation and stabilisation to accommodate given constraints and unknowns, design of matched filters as subsystems for use in pulse communication systems;

EP2fl a thorough understanding and critical evaluation of current tools and practices used to develop DSP systems, construct models and simulate selected DSP systems to solve real, practical problems and demonstrate the limitations of modelling;

EP3fl the ability to select, report and apply a suitable design process and design methodology for the implementation of a particular DSP-enabled telecommunication system given speed, capacity and cost constraints in commercially available subsystems;

EP4fl understanding of different roles within an engineering team, as a team member or a leader, and exercise initiative and personal responsibility within their role.

MSc Telecommunications with Satellite and Broadband Technologies

Graduates will be able to demonstrate:

EP1fl advanced-level knowledge and understanding of satellite and terrestrial broadband systems and radio network infrastructures, assess the reliability of equipment and link conditions;

EP2fl a thorough understanding and critical evaluation of current tools and practices used to develop satellite and broadband systems, construct models and simulate selected scenarios to solve real, practical problems and demonstrate the limitations of modelling;

EP3fl the ability to select, report and apply a suitable design process and design methodology for the implementation of a particular satellite/broadband telecommunication system given speed, capacity and cost constraints in commercially available equipment;

EP4fl understanding of different roles within an engineering team, as a team member or a leader, and exercise initiative and personal responsibility within their role.

MSc Telecommunications with Wireless Technologies

Graduates will be able to demonstrate:

EP1fl advanced-level knowledge and understanding of wireless systems and supporting circuitry; MIC and waveguide passive and active components such as filters, antennas, low-noise amplifiers, power amplifiers and linearizers;

EP2fl a thorough understanding and critical evaluation of current tools and practices used to develop wireless network systems, design and simulate circuits and subsystems to demonstrate the limitations of modelling;

EP3fl the ability to select, report and apply a suitable design process and design methodology for the implementation of a particular wireless system using device design techniques to augment commercially available components;

EP4fl understanding of different roles within an engineering team, as a team member or a leader, and exercise initiative and personal responsibility within their role.

Course structure

Course structure for
MSc Telecommunications with Digital Signal Processing

This section illustrates the core and option modules available as part of the MSc Telecommunications with Digital Signal Processing course and their credit value. Full-time Postgraduate students study 180 credits per year. The course consists of three taught modules (40 credits each) plus an individual project (60 credits).

Credit Level 7				
Module code	**Module title**	**Status**	**UK credit**	**ECTS**
TC1	Telecommunications	Core	40	20
C2.1	Digital Signal Processing	Core	40	20
P1	Project	Core	60	30
One from:				
E1	Electronics	Option	40	20
E2.1	Robotic and Control Systems	Option	40	20
E2.2	Embedded Systems	Option	40	20
E2.3	System-on-Chip Technologies	Option	40	20
E2.4	Medical Instrumentation	Option	40	20
CN1	Computer Networks	Option	40	20
N2.1	Security	Option	40	20
N2.2	Communication Networks	Option	40	20
N2.3	Cloud Technologies	Option	40	20
C2.2	Satellite and Broadband Communications	Option	40	20
C2.3	Wireless Technologies	Option	40	20

Please note: Not all option modules will necessarily be offered in any one year.

Course structure for
MSc Telecommunications with Satellite and Broadband Technologies

This section illustrates the core and option modules available as part of the MSc Telecommunications with Satellite and Broadband Technologies course and their credit value. Full-time Postgraduate students study 180 credits per year. The course consists of three taught modules (40 credits each) plus an individual project (60 credits).

Credit Level 7				
Module code	**Module title**	**Status**	**UK credit**	**ECTS**
TC1	Telecommunications	Core	40	20
C2.2	Satellite and Broadband Communications	Core	40	20
P1	Project	Core	60	30
One from:				
E1	Electronics	Option	40	20
E2.1	Robotic and Control Systems	Option	40	20
E2.2	Embedded Systems	Option	40	20
E2.3	System-on-Chip Technologies	Option	40	20
E2.4	Medical Instrumentation	Option	40	20
CN1	Computer Networks	Option	40	20
N2.1	Security	Option	40	20
N2.2	Communication Networks	Option	40	20
N2.3	Cloud Technologies	Option	40	20
C2.1	Digital Signal Processing	Option	40	20
C2.3	Wireless Technologies	Option	40	20

Please note: Not all option modules will necessarily be offered in any one year.

Course structure for
MSc Telecommunications with Wireless Technologies

This section illustrates the core and option modules available as part of the MSc Telecommunications with Wireless Technologies course and their credit value. Full-time Postgraduate students study 180 credits per year. The course consists of three taught modules (40 credits each) plus an individual project (60 credits).

Credit Level 7				
Module code	**Module title**	**Status**	**UK credit**	**ECTS**
TC1	Telecommunications	Core	40	20
C2.3	Wireless Technologies	Core	40	20
P1	Project	Core	60	30
One from:				
E1	Electronics	Option	40	20
E2.1	Robotic and Control Systems	Option	40	20
E2.2	Embedded Systems	Option	40	20
E2.3	System-on-Chip Technologies	Option	40	20
E2.4	Medical Instrumentation	Option	40	20
CN1	Computer Networks	Option	40	20
N2.1	Security	Option	40	20
N2.2	Communication Networks	Option	40	20
N2.3	Cloud Technologies	Option	40	20
C2.1	Digital Signal Processing	Option	40	20
C2.2	Satellite and Broadband Communications	Option	40	20

Please note: Not all option modules will necessarily be offered in any one year.

Teaching, Learning and Assessment Methods

Teaching

The taught portion of the courses comprises three 40 credit intensive short courses. The weekly tutorials which follow delivery of these course modules aid the student's assimilation of module subject matter.

Meanwhile, at the end of each module the student is assigned a substantial work package which exercises the concepts just studied. The makeup of these intervening work assignments (each one known as an Independent Learning Package (ILP)) varies with the content of the associated short courses. In most cases, ILPs incorporate design or simulation activities alongside written problem solutions.

Each ILP requires submission of a portfolio of results in order to consolidate understanding of an individual short course's material. This forms the basis for the assessment of the student's subject proficiency. The ILP portfolio includes a written report that summarises problem solutions and/or findings from the technical investigations that have been assigned.

Sequentially engaging each module in isolation permits the student to concentrate attention just on the most recently-taught subject material, thereby promoting efficient focused learning. This course structure is also quite flexible, affording industry-based students an opportunity to attend and accumulate module credits over an extended period of time, while simultaneously serving a full-time student cohort that generally progresses through the MSc pathway in a single calendar year.

Assessment

Assessment of Learning Modules

The student must submit a completed ILP in the form of a report that contains a critical, reflective and detailed description of the independent work carried out and the results of the investigations assigned. While the short course elements build a skills baseline, the ILP work extends and sharpens the student's knowledge base of the taught material. The short course portion of a module is not explicitly subject to assessment, whereas ILPs are.

Once the student submits the ILP report, an oral examination is held with an ILP Panel consisting of at least two staff members who will determine the level of student achievement. After thorough scrutiny of the written evidence and hearing the oral defence, the Panel decides whether the outcome is a Pass with Distinction, Pass with Merit, Pass or Fail; this result then becomes a recommendation to the Assessment Board. The proceedings of the oral examinations are recorded for External Examiners' perusal.

Students must achieve at least a Pass to be awarded the credit for that module. Specifically, the criteria used for assessment are the learning outcomes of each module.

Assessment Criteria:

In order to pass a module:

1. the student must demonstrate competence in each and every learning outcome either through the written ILP submission or during the oral 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 oral examination must verify that the student has ownership of the ILP material and is able to defend it effectively.

The major purposes of the oral 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 oral examination, without reasonable cause supported by evidence submitted in accordance with the University's mitigating 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. the ability to handle technical questions during the oral examination with confidence and fluency;
4. the ability to demonstrate in-depth knowhow in their subject matter;
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 with Distinction, Pass with Merit, Pass, or Fail decision.

Failure to submit the thesis by the deadline agreed by the student or absence from the oral examination, without reasonable cause supported by evidence submitted in accordance with the University's mitigating 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 handbook of academic regulations. Information regarding assessment can also be found in Section 5 of the essential Westminster Information Guide published by the University.

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. the ability to handle technical questions during the oral examination with confidence and fluency;
7. evidence of the student extending the original scope of the project.

A structured procedure is employed in grading both the thesis and performance during the oral presentation. The Project Review Panel consists of a Supervisor, an Assessor and a 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 oral 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 oral examination. The two forms of assessment collectively ensure that the learning outcomes of the Project are achieved for it to be passed. However, the oral 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-calibre ILP will be awarded a Merit grade, a Merit-calibre ILP will be awarded a Pass and a Pass-calibre report will stay a Pass grade. That is, a drop of a band, expect if the original work is of Pass quality in the first place.

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 oral 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:

- Electronics with Robotic and Control Systems,
- Electronics with Embedded Systems,
- Electronics with System-on-Chip Technologies,
- Electronics with Medical Instrumentation,
- Telecommunications with Digital Signal Processing,

- Telecommunications with Satellite and Broadband Technologies,
- Telecommunications with Wireless Technologies,
- Computer Networks with Security,
- Computer Networks and Communications,
- Computer Networks with Cloud Technologies

The role of the Subject/Conferment Board is to ratify 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. In such cases, it will recommend that the Subject/Conferment Board compensate appropriately for the mitigating circumstances.

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 oral examinations and to archive these recordings 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 oral examinations for ILPs and projects;
- attending assessment boards;
- providing an annual report to the University on the operation of the course and assessment procedures.

Academic regulations for the MSc Telecommunications with

- Digital Signal Processing
- Satellite and Broadband Communications
- Wireless Technologies

and their intermediate awards operate in accordance with the University's Academic Regulations and the UK Quality Code for Higher Education Part A: Setting and Maintaining Academic Standards, Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies document published by the Quality Assurance Agency for Higher Education (QAA) in October 2014.

All students should make sure that they access a copy of the current edition of the general University handbook called Essential Westminster, which is available at http://www.westminster.ac.uk/study/current-students/resources/essential-westminster. The following regulations should be read in conjunction with Section 18: Modular Framework for Postgraduate Courses and relevant sections of the current Handbook of Academic Regulations, which is available at westminster.ac.uk/academic-regulations.

Award of Master of Science (MSc) Degree

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

(a) obtained a minimum of 180 credits accrued from the Project plus three 40-credit taught modules forming their course, normally including all the core taught modules;
(b) attempted modules worth no more than 240 credits.

Note: 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 referral at the first sitting will not count as a further separate attempt.

The MSc Degree may be awarded with Merit normally if the student has:

(a) passed the Project at the first attempt without reassessment;
(b) not failed, or been re-assessed in more than one taught module;
(c) accrued at least
  (i) 100 credits with Merit, or
  (ii) 80 credits with Distinction

The MSc Degree may be awarded with Distinction normally if the student has:

(a) passed the Project at the first attempt without reassessment;
(b) not failed, or been re-assessed in more than one taught module;
(c) accrued at least
  (i) 180 credits with Merit or Distinction including 100 credits with Distinction, or
  (ii) 140 credits with Distinction.

Award of the Postgraduate Diploma (PgDip)

To be eligible for the award of a Postgraduate Diploma (PgDip), a student must have obtained a minimum of 120 credits accrued from the modules forming their course, including:

- a core module, and
- a second core module or the Project

The Postgraduate Diploma may be awarded with Merit normally if the student has accrued 120 credits at the first attempt including 80 credits with Merit or Distinction.

The Postgraduate Diploma may be awarded with Distinction normally if the student has accrued 120 credits at the first attempt with Merit or Distinction including 80 credits with Distinction.

Award of a Postgraduate Certificate (PgCert)

To be eligible for the award of a Postgraduate Certificate, a student must have a minimum of 60 credits.

The Postgraduate Certificate may be awarded with Merit normally if the student has accrued 60 credits at the first attempt with Merit or Distinction.

The Postgraduate Diploma may be awarded with Distinction normally if the student has accrued 60 credits at the first attempt with Distinction.

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

Statutes of Limitations

The time limit for a student to complete their programme of study shall be as follows:

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

The Subject/Conferment Board may exclude the student from the programme of study where a student, having attempted modules worth more than 80 credits, has:

(a) failed modules worth ***more*** than **1/3** of total credits attempted, or
(b) has failed and cannot have a further attempt at a core module, and
(c) 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.

Normally, this would not be recommended by the Board if the student has passed at least **three** taught modules at the first attempt without reassessment.

Support for students

Upon 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 Faculty Registry. Students will be directed to where they can find an online 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 four libraries, each holding a collection of resources related to the subjects taught at their Faculty. Students can search the entire library collection online through the Library Search service to find and reserve printed books, and access electronic resources (databases, e-journals, e-books).

Students can choose to study in the libraries, which have areas for silent and group study, desktop computers, laptops for loan, photocopying and printing services. They can also choose from several computer rooms at each campus where desktop computers are available with the general and specialist software that supports the courses taught at their Faculty. Students can also securely connect their own laptops and mobile devices to the University wireless network.

The University uses a Virtual Learning Environment called Blackboard where students access their course materials, and can communicate and collaborate with staff and other students.

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 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

- Staff research and development in Electronics and Communications
- Industrial Advisory Panel
- University of Westminster Mission Statement
- University teaching and learning policies
- University quality assurance handbook and Modular Frameworks
- Handbook of Academic Regulations
- Faculty of Science and Technology teaching, learning and assessment strategies

Externally

- UK-SPEC (Engineering Council's UK Standard for Professional Engineering Competence) The Accreditation of Higher Engineering Programmes, 3rd edition, 2014
- IET (Institution of Engineering and Technology) Academic Accreditation Guidelines, 2015
- Accreditation of Higher Education Programmes (AHEP), Third Edition, 2014

- QAA Subject Benchmark for Engineering, draft document, 2014

Professional body accreditation

Our aim is to secure IET accreditation for the MSc Degree Programmes detailed in this document.

Quality management and enhancement

Course management

The Telecommunications suite of MSc courses is delivered by the Department of Engineering.

Course approval, monitoring and review

The suite of courses was initially approved by a University Validation Panel in 2015. The Panel included internal peers from the University and external subject specialists from academia as well as industry to ensure the comparability of the courses to those offered in other universities and the relevance to industry. 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 course pathways are monitored each year by the Faculty to ensure it is running effectively and that issues which might affect the student experience have been appropriately addressed. Staff will consider evidence about the course, including the outcomes from each Course Committee, evidence of student progression and achievement and the reports from External Examiners, to evaluate the suitability of the course. The Annual Monitoring Sub-Committee considers the Faculty action plans resulting from this process and the outcomes are reported to the Academic Council, 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 views are taken seriously. Student feedback is gathered in a variety of ways. 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 various discussions. The University and the Students' Union work together to provide a full induction so that the elected student representatives fully understand their roles and the role of the Course Committees.

All students are invited to complete a Module Feedback 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. The University also has an annual Student Experience Survey, which elicits feedback from students about their course and their University experiences.

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 feedback from course committees is part of the Faculty's quality assurance evidence base.

For more information about the Telecommunications Suite of MSc courses, please contact:
Dr G Charalambous charalg@westminster.ac.uk

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, content, teaching, learning and assessment methods for each module.