

## Programme Specification

### Course record information

Name and level of final award:	MSc Computer Networks with Security, MSc Computer Networks with Communications, MSc Computer Networks with Cloud Technologies,
Name and level of intermediate awards:	Postgraduate Diploma (PGDip) Computer Networks Postgraduate Certificate (PGCert) Computer Networks
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-year); Part-Time (Three-year)
University of Westminster course code:	
JACS code:	I120
UCAS code:	
QAA subject benchmarking group:	Electronic Engineering Computer Science
Professional body accreditation:	IET/BCS
Date of course validation/review:	2015
Date of programme specification:	2015

## **Admissions requirements for all courses**

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

## **Aims of the courses**

The overall aim of the networks suite of MSc courses is to provide an enriching learning experience, enhancing the knowledge and skill base of the participating students in the areas of networks, and communications. 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.
- 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.

## **Aims common to all courses in the networks suite**

### **MSc Computer Networks with: /Security /Communications /Cloud Technologies**

The common aims of the courses are to:

- CN1. update and extend the students' knowledge and capabilities in the integration and use of interconnected computer systems.
- CN2. 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.
- CN3. 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.
- CN4. develop the students' ability to design, plan and implement such systems.
- CN5. provide an in-depth understanding of routing and switching technologies.

- CN6. develop skills in designing, testing and troubleshooting local and wide area networks.

### MSc Computer Networks with Security

In addition, the MSc in Computer Networks with Security aims to produce postgraduates with an advanced understanding of modern network based systems with the integrated need of security including both the physical and software aspects of such interconnection with hands-on experience of the planning, implementation and maintenance of such systems. The course aims to prepare a student with specialist knowledge and skillset in key areas such as threat analysis, network security systems, cryptography, cybersecurity, penetration testing, wireless security and information security.

In particular, the course aims to:

- CNS1. assess confidentiality, integrity and availability in security terms;
- CNS2. develop the ability to critically evaluate the threats and vulnerabilities of network systems and to provide, implement and integrate security strategies;
- CNS3. develop the ability to critically evaluate and implement principles and practices used in modern day cryptography used to secure data and communication used in modern day computer network systems;
- CNS4. explore current security tools used in penetration testing;
- CNS5. provide hands on experience at configuring enterprise level security appliances such as firewalls, intrusion prevention systems and VPNs.

### MSc Computer Networks with Communications

In addition, the MSc in Computer Networks with Communications aims to produce postgraduates with an advanced understanding of computer networks including both the physical and software aspects of such interconnection with hands-on experience of the planning, implementation and maintenance of such systems. The course aims to prepare a student with specialist knowledge and skillset in key areas such as network design, storage area networks, optical networking, network simulation, network redundancy and reliability.

In particular, the course aims to:

- CNC1. develop the ability to model the behaviour of modern day network systems to design and critically evaluate such systems at all levels of the OSI model;
- CNC2. develop the ability to critically evaluate and integrate devices and components used for high speed fibre optical communication systems;
- CNC3. explore the economic criteria that must be met so as to attain the best management of traffic at minimum cost;
- CNC4. review commonly used network simulators, commercial and academic, their common and specific purposes and architectures;

- CNC5. enable the student to apply a holistic understanding of networks and their applications in solving real world problems.

### **MSc Computer Networks with Cloud Technologies**

In addition, the MSc in Computer Networks with Cloud Technologies aims to produce postgraduates with an advanced understanding of networks of computers with the use of Cloud based systems including both the physical and software aspects of such interconnection with hands-on experience of the planning, implementation and maintenance of such systems. The course aims to prepare a student with specialist knowledge and skillset in key areas such as cloud architecture, modelling tools, virtualisation, distributed systems, cloud services and management.

In particular, the course aims to:

- CNCT1. develop the ability to define and implement fundamental concepts used for distributed based architectures and cloud based systems;
- CNCT2. develop the ability to critically evaluate and analyse the associated architectures, management protocols and associated policies for cloud based systems;
- CNCT3. provide a wide treatment of cloud computing that covers Infrastructure-as-a-Service, Platform-as-a-Service, Software-as-a-Service as the many integration and management components that are necessary to make these work together to fulfil business requirements;
- CNCT4. develop technical solutions and strategies for cloud systems' management and operations;
- CNCT5. provide experience in the design and implementation of distributed systems and to build applications in the cloud using platforms and toolkits such as Google App Engine, VMware Cloud Foundry, Microsoft Windows Azure, CloudSim, CloudBees, GigaSpaces.

### **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 subject areas covered within the three pathways in the networks suite of MSc courses offer students an excellent opportunity to enable the successful graduate to enter into these ever expanding, fast growing and dominant areas within the network engineering sector.

Skills in design, installation, configuration, optimisation, security and management of these networks are highly desirable. The demand for engineers has been rising steadily over the past few years and there are skills shortages for engineers in some areas such as cybersecurity and cloud computing.

Examples of possible career paths for graduates in the areas of networks are:

- Network Support Engineer
- Network Design Architect
- Network Manager
- Project Manager
- Security Auditor
- Network Security Architect
- Distributed Systems Engineer
- Teaching
- Research and Development

The list above is not prescriptive or exhaustive.

### **MSc Computer Networks with: /Security /Communications /Cloud Technologies**

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 these fields.

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 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 in any of the Computer Network based degrees will have the knowledge and skills to work in these rapidly developing fields.

## **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 Computer Networks with Security**

Graduates will be able to demonstrate:

- SM1fl a comprehensive understanding of the scientific principles and the mathematics involved in cryptographic techniques;
- SM2fl an awareness of the limitations of security protocols and the threats they pose;
- SM3fl a comprehensive knowledge and understanding of the goals of security and an appreciation of their limitations.

#### **MSc Computer Networks with Communications**

Graduates will be able to demonstrate:

- SM1fl a comprehensive understanding of the scientific principles of communication networks and related disciplines;
- SM2fl a critical awareness of the limitations of server hardware and the impact on performance;
- SM3fl a comprehensive knowledge and understanding of mathematical and computer models relevant to network communications and performance, and an appreciation of their limitations.

#### **MSc Computer Networks with Cloud Technologies**

Graduates will be able to demonstrate:

- SM1fl a comprehensive understanding of cloud architecture and services such as IaaS (Infrastructure as a Service), PaaS (Platform as a Service) and SaaS (Software as a Service);
- SM2fl a critical awareness of the security issues in cloud computing;
- SM3fl a comprehensive knowledge and understanding of security and management strategies and a critical evaluation of these.

### **2. Engineering Analysis**

#### **MSc Computer Networks with Security**

Graduates will be able to demonstrate:

- EA1fl ability to analyse a problem related to security needs within an organisation and to apply security techniques to design and implement a security strategy and assess its limitations;
- EA2fl ability to use fundamental knowledge to investigate new and emerging security threats, protocols and mitigation;

- EA3fl ability to extract data pertinent to an unfamiliar problem, and apply in its solution using computer based engineering tools in gathering information during reconnaissance.

### **MSc Computer Networks with Communications**

Graduates will be able to demonstrate:

- EA1fl ability to breakdown a complex task to fundamental building blocks and apply knowledge of networks and communication to design a computer network architecture and assess its limitation; Simulate the operation of network and evaluate its performance to identify its limitations;
- EA2fl ability to use fundamental knowledge to investigate new and emerging technologies impacting computer networks and digital communications;
- EA3fl ability to collect and analyse data from network simulations to tackle performance issues in unfamiliar network configurations.

### **MSc Computer Networks with Cloud Technologies**

Graduates will be able to demonstrate:

- EA1fl ability to apply computer-based models for solving networking and distributed computing problems, and the ability to assess the limitations of particular cases;
- EA2fl ability to apply use fundamental knowledge to investigate new and emerging cloud technologies;
- EA3fl ability to collect and analyse data from simulations of a cloud architecture to investigate performance issues in unfamiliar design configurations.

## **3. Design**

### **MSc Computer Networks with Security**

Graduates will be able to demonstrate:

- D1fl ability to use knowledge, understanding and skills to work with information that may be incomplete and use theory to mitigate deficiencies in designing a computer network security strategy;
- D2fl wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations to design a security strategy;
- D3fl ability to work independently to solve complex problems associated with the design of a secure system based on a given problem specification.

### **MSc Computer Networks with Communications**

Graduates will be able to demonstrate:

- D1fl ability to use knowledge, understanding and skills to work with information that may be incomplete and use theory to mitigate deficiencies in designing network layer addressing schemes and a complete network;
- D2fl knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations in



designing an enterprise network;

- D3fl ability to work independently to solve complex problems associated with the design of an optimised computer network that implements a variety of network technologies.

### **MSc Computer Networks with Cloud Technologies**

Graduates will be able to demonstrate:

- D1fl ability to use knowledge, understanding and skills to work with information that may be incomplete and use theory to mitigate deficiencies with design of a cloud systems offering a variety of cloud services;
- D2fl knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations in designing a cloud system;
- D3fl ability to work independently to solve complex problems associated with the design of an optimised cloud network that implements a variety of cloud services.

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

### **MSc Computer Networks with: /Security /Communications /Cloud Technologies**

Graduates will be able to demonstrate:

- ET1fl ability to fully articulate the importance of high levels of professional and ethical conduct in engineering;
- ET2fl 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 networked systems;
- ET3fl ability to communicate an objective defence of the chosen business arguments taking into account commercial risk, codes of practice, safety requirements and the social impact of networked systems;
- ET4fl ability to identify required resources and design processes that will ensure sustainable development;
- ET5fl awareness of relevant regulatory requirements in the area of networked systems;
- ET6fl ability to evaluate health & safety, commercial and environmental risks related to networked systems.

## **5. Engineering Practice**

### **MSc Computer Networks with Security**

Graduates will be able to demonstrate:

- EP1fl an advanced level knowledge and understanding of network security appliances such as Intrusion Prevention Systems (IPS), packet filtering firewalls, stateful firewalls, proxy servers and Virtual Private Network (VPN) gateways;
- EP2fl a thorough understanding of current practice in cryptographic techniques and its limitations, and some appreciation of likely new developments;

- EP3fl ability to apply extensive knowledge and understanding of a wide range of design techniques and applicable technologies, along with the constraints they impose;
- EP4fl understanding of different roles within an engineering team and exercise initiative and personal responsibility as a team member in a group project.

### **MSc Computer Networks with Communications**

Graduates will be able to demonstrate:

- EP1fl an advanced level knowledge and understanding of network components and subsystems including routers, switches, servers, access points, storage devices and transmission media;
- EP2fl a thorough understanding of current practice in network design, implementation and management together with their limitations and some appreciation of likely new developments;
- EP3fl ability to apply extensive knowledge and understanding of a wide range of design techniques and applicable technologies, along with the constraints they impose;
- EP4fl understanding of different roles within an engineering team and exercise initiative and personal responsibility as a team member in a group project.

### **MSc Computer Networks with Cloud Technologies**

Graduates will be able to demonstrate:

- EP1fl an advanced level knowledge and understanding of a wide range of cloud system components including routers, switches, transmission media, firewalls, storage devices, servers and related software components.
- EP2fl a thorough understanding of current practice in cloud design and security implementations together with their limitations and some appreciation of likely new developments;
- EP3fl ability to apply extensive knowledge and understanding of a wide range of design techniques and applicable technologies, along with the constraints they impose;
- EP4fl understanding of different roles within an engineering team and exercise initiative and personal responsibility as a team member in a group project.

## 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 per year.

Each of them consists of three taught modules (40 credits each) plus an individual project (60 credits)

### MSc Computer Networks with Security

Credit Level 7				
Module code	Module title	Status	UK credit	ECTS
CN1	Computer Networks	Core	40	20
N2.1	Security	Core	40	20
P1	Project	Core	60	30
<b>One from:</b>				
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
N2.2	Communication Networks	Option	40	20
N2.3	Cloud Technologies	Option	40	20
TC1	Telecommunications	Option	40	20
C2.1	Digital Signal Processing	Option	40	20
C2.2	Satellite and Broadband Communications	Option	40	20
C2.3	Wireless Technologies	Option	40	20

## MSc Computer Networks with Communications

Credit Level 7				
Module code	Module title	Status	UK credit	ECTS
CN1	Computer Networks	Core	40	20
N2.2	Communication Networks	Core	40	20
P1	Project	Core	60	30
<b>One from:</b>				
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
N2.1	Security	Option	40	20
N2.3	Cloud Technologies	Option	40	20
TC1	Telecommunications	Option	40	20
C2.1	Digital Signal Processing	Option	40	20
C2.2	Satellite and Broadband Communications	Option	40	20
C2.3	Wireless Technologies	Option	40	20

## MSc Computer Networks with Cloud Technologies

Credit Level 7				
Module code	Module title	Status	UK credit	ECTS
CN1	Computer Networks	Core	40	20
N2.3	Cloud Technologies	Core	40	20
P1	Project	Core	60	30
<b>One from:</b>				
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
N2.1	Security	Option	40	20
N2.2	Communication Networks	Option	40	20
TC1	Telecommunications	Option	40	20
C2.1	Digital Signal Processing	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.

## **Learning, teaching and assessment methods**

### **Teaching and Learning**

The taught portion of the courses is delivered in three highly concentrated 40 credit modules which we call learning modules. The teaching within these modules is delivered in the format of an industrial short course. This delivery style allows students to rapidly gain a full overview of the horizons of the subject matter and furthermore enables the student to achieve a state of relevant functionality without a great deal of elapsed time. This can be especially advantageous if the student is attending on an occasional basis, or has urgent needs of immediate skill in a given topic area at his/her place of work. Within the taught portion of each module there is adequate time given to “hands-on” practice of concepts and tools taught. Any assignments and exercises carried out within the taught portion of a module are meant to develop basic capability and, as such, serve as a useful vehicle for sharpening the skills baseline required for undertaking the portfolio of work. The ILP consists of a collection of short answer, long answer and open ended project based tasks that must be solved. In most cases, ILPs incorporate design or simulation activities alongside written problem solutions. The project based task within the ILP will require the student to exercise and use principles, concepts and technologies within the specialism of the module to design, implement and verify the operation of a complex real system. In some modules the project component maybe in the form of a group project whilst in other modules the project component maybe in the form of an individual project.

Each taught module is allocated 400 hours of study time. Out of this time 70 hours or 10 working days are allocated to the delivery of the taught portion of the module, 16 hours are allocated to additional tutorial sessions and the remaining 314 hours are allocated to the student to work on and complete the ILP. To enable the student to further practice and solidify their understanding of material taught and their abilities in using the relevant tool sets additional tutorials outside of the taught portion of the module are provided. These tutorials provide just in time practice sessions during the ILP period of the module. The ILP is where the remaining learning takes place, where abundant ‘soak-time’ to solve the portfolio of work described within the ILP package document is given. The performance of work carried out for the ILP can take place at the university, within the students place of work or at their home.

### **Assessment Methods**

#### **Assessment of Learning Modules**

The assessment for the learning modules is formed by setting a portfolio of work known as an Independent Learning Package (ILP) that the student must complete. The ILP typically consists of short answer, long answer and open ended project based assignments and small tasks. The student must submit their completed ILP work in the form of an ILP report that will contain a critical, reflective and detailed description of the independent work carried out by the student and the results achieved by the student.

Unlike the tasks set in the ILP, exercises carried out in the taught portion 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. The taught 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 video recorded for External Examiners' perusal.

Students must achieve at least a pass to be awarded the credits for that module. Specifically the criteria used for assessment are the learning outcomes of each Learning 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 distinction pass, merit pass, 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 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 handbook of academic regulations. You can also find information regarding assessment 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 candidate 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 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 the 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 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 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 with 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

The MSc Computer Networks with

- Security
- Communications
- Cloud 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](http://www.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:

- obtained a minimum of 180 credits accrued from the Project and three taught modules forming their course, normally including all the core taught modules;
- 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 sit will not count as a further separate attempt.

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

- passed the Project at the first attempt without reassessment;
- not failed, or been re-assessed in more than one taught module;
- accrued at least
  - 100 credits with Merit, or
  - 80 credits with Distinction.

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

- passed the Project at the first attempt without reassessment;
- 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

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

Where a student, having attempted modules worth more than 80 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** 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, 3<sup>rd</sup> 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 obtain IET and BCS accreditation for the MSc Degree Programmes detailed in this document.

### **Quality management and enhancement**

#### **Course management**

The Networks 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.

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