

## Programme Specification Pro-forma (PSP)

### 1. GENERAL INFORMATION

1. Programme Title:	Advanced Internetwork Engineering
2. Final Award:	MSc
3. Exit Awards:	PgC/PgD
4. Awarding Body:	Glasgow Caledonian University
5. Approval Date:	19th November 2018
6. School:	Computing, Engineering and Built Environment
7. Host Department:	Department of Cyber Security and Networks
8. UCAS Code:	N/A
9. PSB Involvement:	N/A
10. Place of Delivery:	GCU Campus
11. Subject Benchmark Statement:	Computing
12. Dates of PSP Preparation/Revision:	June 2019

### 2. EDUCATIONAL AIMS OF THE PROGRAMME

An introduction should be included here which describes the overall aim of the programme together with the educational aims of the programme at the exit points

The aim of this programme is to provide students with the theoretical and practical skills necessary to pursue careers as high level network professionals. It is concerned with the design, implementation and troubleshooting of complex computer network infrastructures and includes an examination of the technologies, methods, and design approaches used in the development of such infrastructures.

The programme aims are to:

- Develop an understanding of the established theories, principles and concepts and emerging issues in computer network engineering.
- Develop an ability to deploy established design principles within complex networking projects and to critically appraise their use.
- Develop a critical awareness of current issues in the development of computer network engineering which is informed by advanced practice in the field and relevant research.
- Analyze increasingly complex inter-related network requirements and implement appropriate solutions within tight time constraints.
- Develop the employability of students including the ability to communicate effectively both orally and in writing, using a range of media.
- Develop the ability to work independently.

### **3. INTENDED LEARNING OUTCOMES**

The programme outcomes have been formulated with reference to the following documents and sources:

- Scottish Credit and Qualifications Framework, Level 11 MSc
- GCU University Qualifications Framework for MSc
- QAA Benchmark Statement of Computing

The Programme Learning outcomes detailed below are mapped against the specific Module Learning Outcomes in the Curriculum Map presented in Appendix 1.

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills, qualities and other attributes in the following areas:

#### **3A Knowledge and understanding;**

- A1: Explain theoretical and practical concepts of complex computer network systems.
- A2: Compare processes, methods, techniques, tools and technologies used in complex computer network systems.
- A3: Assess the commercial, organisational and professional issues that constrain the development of a complex computer network.
- A4: Describe the principles and operation of complex computer network protocols.
- A5: Examine advanced processes, methods, techniques, tools and technologies used to develop, evolve and support the operation of a complex computer network.
- A6: A comprehensive knowledge and understanding of professional and ethical responsibilities.

#### **3B Practice: Applied knowledge, skills and understanding;**

- B1: Analyse the needs of a commercial or industrial business problem requiring a complex computer network.
- B2: Specify a set of computer network requirements to meet the needs of the commercial or business problem.
- B3: Generate a computer network design that satisfies the computer network requirements.
- B4: Build a computer network that realises the computer network design.
- B5: Verify that the computer network matches the computer network design.
- B6: Define a problem, research its background, understand the social and cultural context, identify constraints, understand business and user needs, identify and manage cost drivers, ensure fitness for purpose and manage the design process and evaluate outcomes.

#### **3C Generic cognitive skills;**

- C1: Demonstrate logical thinking and problem solving.
- C2: Critical analysis / evaluate work undertaken by themselves and others.
- C3: Demonstrate effective information management, retrieval and research skills for independent enquiry and learning.
- C4: Evaluate alternative solutions to problems in an appropriate subject domain.

#### **3D Communication, numeracy and ICT skills**

- D1: Demonstrate communication skills (Electronic, written, oral and listening) necessary to make effective presentation of a technical nature (information, ideas, problems and their solution) to a range of audiences.
- D2: Demonstrate numeracy in both understanding and presenting cases involving a

quantitative dimension.

D3: Computer literacy.

D4: Presentation skills.

### **3E     Autonomy, accountability and working with others.**

E1: Demonstrate self-confidence, self-discipline and self-reliance (independent working)

E2: Demonstrate an awareness of personal strengths and weaknesses

E3: Demonstrate creativity, innovation and independent thinking.

E4: Demonstrate the ability to work with others.

E5: Demonstrate an appreciation and desire for the need to reflect, and plan for self-learning and improving performance as the foundation for CPD and life-long learning.

E6: Demonstrate reliability, integrity, honesty and ethical awareness.

#### **Delivery, Teaching, learning and assessment methods used to enable outcomes to be achieved and demonstrated:**

##### Delivery method

Each Trimester consists of a 12 week block during which students will study all modules for that Trimester and have time for consolidation and private study. Six modules are used to deliver the technical content of the curriculum (Layer 2 Technologies, Layer 3 Technologies 1 and 2 in trimester 1, followed by Multicast and WAN Technologies, VPN and Security Technologies and Infrastructure Services in Trimester 2) While no module is technically a prerequisite for another, these modules are delivered sequentially in order to allow students to build their knowledge from the core connectivity technologies out to the security and services technologies which rely on that core. Modules are taught with double contact over 4 (15 credit) weeks.

Two modules, Integrating Network Technologies and Research Methods will be delivered 'long-thin' across both trimesters. Integrating Network Technologies runs in parallel to the technical modules and draws on the content of those modules to build the students ability to critically analyse and implement solutions for increasingly complex problem scenarios. The existing Research Methods module is used by current postgraduate programmes and is delivered long-thin. Class contact will be lectures, tutorials, seminars and laboratory sessions as appropriate. Each module has an appropriate handbook detailing the module descriptor, learning outcomes, and assessment strategies adopted.

Students also have the option of taking the programme through online (DL) and part time (PT) delivery.

##### Teaching, learning and assessment methods

This programme will employ new teaching practices which make more use of the technologies available in networking. Remote rack access will be used during lectures so that students will be able to watch lecturers implement the technologies under discussion 'live'. This will enhance traditional chalk and talk teaching because students will be see the technologies being used to build and verify the operation of real networks. It is anticipated that this will improve their performance in lab sessions as they will have already seen examples of how to build similar networks (and troubleshoot them). It will also help to bring what can be a dry subject area to life.

The University managed learning Environment (GCULearn) will be employed to host recording of lectures and online tutorials on specific key or problematic topics.

Labs will utilise remote rack access which allows our students to access a full rack of routers and switches via the Internet. This allows us to be very open in room allocation and will allow us to deal with any access

issues faced by students as flexibly as possible. The remote access system can save the students work at the end of a session and allow them to go back to where they left off when they get home or at their leisure. Close supervision of labs will allow us to identify problem areas and provide feedback through the weekly tutorials so that students do not carry gaps or misunderstandings as they progress.

Collaboration and conferencing tools will be used to encourage student engagement and an emphasis will be placed on real-world situations. This will be reflected both in teaching via examples and tutorials, and in assessment which will include case studies intended to develop both technical and soft skills.

In general, a number of integrated approaches are employed to achieve the necessary aims, objectives and learning outcomes required at this advanced level. To this end, a variety of teaching and learning methods and strategies are applied on the programme appropriate to the module material and to the specific aims and objectives involved. For example, some of the modules are heavily weighted towards the development of real-world skills, whilst others are more discursive and presentation based. These therefore require different teaching and learning approaches. Therefore in addition to the more traditional lectures and tutorial approach, a range of other suitable teaching and learning approaches will be adopted and examples of these will include:

- Student and tutor led seminars
- Industrial guest seminars
- Research seminars
- Formative assessments
- Self-directed and independent learning
- Problem solving practical laboratories
- Managed Learning Environments (e.g. GCULearn)
- Student presentations
- Group projects
- Industrial case studies
- Problem-based learning scenarios
- Research based teaching materials and methods

The tutorial and laboratory work is integrated as far as possible in order to resolve any issues the student may encounter in understanding particular technologies by referring to concrete examples of their implementation. Both tutorials and labs will be geared to provide real examples and use problem solving to help solidify the concepts and theories learned in lectures.

The assessment strategies will also encompass a range of assessment tools, again dependent on the nature and content of the module aims, objectives and learning outcomes. A novel feature of this programme is that no formal written examinations will be used. The formal exam period tends to break up the academic session, making more difficult to achieve our aim of enabling the students to cope with increasingly complex and inter-related problems as the session progresses. Accordingly, the programme uses a range of coursework based assessments.

Examples of the range of assessment tools include:

- Online tests utilizing diagnostic problem solving and case study scenarios.
- Written reports
- Oral presentations
- Practical lab based tests

The programme employs a streamlined digital assessment strategy which contributes to the provision of rapid feedback for students.

### MSc Project

The project module is a notional 600 hours effort on the part of the student and is supervised by an appropriate academic member of staff. The underlying philosophy of the project is to allow each student to

develop and mature educationally by selecting, studying, analysing and evaluating in depth some problem or area within the named programme discipline. The project offers a further and critical alternative to learning within the traditional lecture/tutorial environment and consequently an alternative method for the student to demonstrate their capabilities and to achieve the key learning objectives required from the module. Projects are normally research, industrially related, or consultancy based. The project is assessed as per the module descriptor:

- Interim Assessment Written Report (10%)
- Oral Presentation (20%)
- Overall Performance and Dissertation (70%)

#### 4. PROGRAMME STRUCTURES AND REQUIREMENTS, LEVELS, MODULES, CREDITS AND AWARDS

All Modules are SCQF Level 11.

The academic year is split into three trimesters, each of 15-16 weeks (12 teaching weeks).

##### MSc/PgD/PgC Advanced Internetwork Engineering (Full/Time)

Trimester A		
Module Code	Module Title	Credits
MMI122895	Layer 2 Technologies	15M
MMI123707	Layer 3 Technologies I	15M
MMI123708	Layer 3 Technologies II	15M
MMI122899	Integrating Network Technologies(trimester 1 and 2)	-
MMI123178	Research and Project Methods (trimester 1 and 2)	-

Trimester B		
Module Code	Module Title	Credits
MMI123709	Security and VPN Technologies	15M
MMI122898	Infrastructure Services	15M
MMI123710	Multicast and WAN Technologies	15M
MMI122899	Integrating Network Technologies (continued)	15M
MMI123178	Research and Project Methods (continued)	15M

**Exit Award – Post Graduate Diploma with 120 credits (or Post Graduate Certificate with 60 credits).**

Trimester C		
Module Code	Module Title	Credits
MMI123177	Masters Project	60M

**Exit Award – Masters Degree with 180 credits**

Each taught trimester has 3 taught modules (which are delivered sequentially) and half of 2 modules which run long-thin across both trimesters (Integrating Network Technologies and Research and Project Methods).

The Integrating Network Technologies module progressively incorporates content from the other technical modules in order to develop the student's ability to solve increasingly complex problems.

## **MSc/PgD/PgC Advanced Internetwork Engineering (Part Time) and MSc/PgD/PgC Advanced Internetwork Engineering (Distance Learning)**

Distance Learning students register for individual modules, however we strongly recommend that they follow the schedule below of two-years plus one trimester. Students following this pathway will take two 15 credit modules (or equivalent halves of long-thin modules) per trimester for two years, followed by the MSc project in Trimester C of the second year, completing their project in the following Trimester A.

Part-time students will be expected to attend campus one day per week to attend classes. .

Students taking the programme in part-time mode have a maximum of 3 years to complete the course. The recommended pathway for both part-time and distance learning students is as follows:

<b>Year 1 - Trimester A</b>		
<b>Module Code</b>	<b>Module Title</b>	<b>Credits</b>
MMI122895	Layer 2 Technologies	15M
MMI123707	Layer 3 Technologies I	15M

<b>Year 1 - Trimester B</b>		
<b>Module Code</b>	<b>Module Title</b>	<b>Credits</b>
MMI122898	Infrastructure Services	15M
MMI123710	Multicast and WAN Technologies	15M

<b>Year 2 - Trimester A</b>		
<b>Module Code</b>	<b>Module Title</b>	<b>Credits</b>
MMI123708	Layer 3 Technologies II	15M
MMI122899	Integrating Network Technologies (part 1)	-
MMI123178	Research and Project Methods (part 1)	-

<b>Year 2 - Trimester B</b>		
<b>Module Code</b>	<b>Module Title</b>	<b>Credits</b>
MMI123709	Security and VPN Technologies	15M
MMI122899	Integrating Network Technologies (continued)	15M
MMI123178	Research and Project Methods (continued)	15M

<b>Year 2 - Trimester C</b>		
<b>Module Code</b>	<b>Module Title</b>	<b>Credits</b>
MMI123177	Masters Project	-

<b>Year 3 - Trimester A</b>		
<b>Module Code</b>	<b>Module Title</b>	<b>Credits</b>
MMI123177	Masters Project (continued)	60M

## 5. SUPPORT FOR STUDENTS AND THEIR LEARNING

### **Student Induction**

Student induction is a formal programme of events which occurs when students initially enrol on the MSc programmes. Students will normally meet the Programme Organiser prior to teaching on the new Session in Trimester 1 in the University and also in the first week of Trimester 2. The programme of events and information includes the following:

- Introduction to Programme Organiser and members of the programme team
- An induction pack which includes a programme information handbook, module descriptors, assessment schedules and a study skills pack.
- Introduction to the programme aims and objectives, the programme content and modes of assessment.
- Introduction to GCULearn services
- Introduction to a personal adviser
- Introduction to LDC
- Tour of the Library and the use of on-line library catalogues
- Tour of the campus

### **Student Support and Counselling**

#### ***IT Support***

The University C&IT (Computer and Information Technology) services provide a range of student support mechanisms through My Caledonian, student email facilities, open access to a number of University Intranet and Internet connected laboratories, and a Learning Café.

The School also has a number of laboratories with University Internet connectivity to allow access to Managed Learning Environments such as GCULearn, which supplement module provision and delivery.

#### ***Academic Support***

Academic support is provided through access to module leaders and tutors. Staff room numbers, email and telephone contact details are provided in the Module Handbooks and can be accessed through a Managed Learning Environment.

In order to provide on-going support for students, academic staff including the Programme Leader operates a policy of open access for consultation and help through email and suitable managed learning environments. If there is a major concern by an individual student, the student is encouraged in the first instance to contact the Programme Leader to discuss their concerns and to help try and facilitate an early resolution. Students are also made aware of the support and guidance offered by the Learning Development Centre and may be referred to the Learning Development Centre as appropriate by both academic and administrative staff.

#### ***Personal Development***

As part of the learning strategy students will participate in Personal Development to ensure that they undertake effective planning for their own personal, educational and career development.

A key element in the process is to foster the employability of graduates. Students will be encouraged to make use of the University Careers Guidance service and other mechanisms in order to develop an awareness of the industry and identify career opportunities. Students will also be encouraged to attend research Seminars and BCS and IET local branch meetings.

#### ***MSc Project Support***

Students who undertake this module are supported through the allocation of an academic supervisor. The academic supervisor is allocated during the development of the Research proposal, as part of the Research Methods module. The programme also has a named academic who acts as the Project Coordinator and who provides overall guidance for both the student cohort and the academic supervisors on the management and assessment procedures of the project. The

Project Coordinator is there to ensure the project runs smoothly and will provide a detailed introductory talk in relation to the running and execution of the Project at the start of it.

The Project Handbook provides all the key information on the running, management and assessment of the project.

## 6. CRITERIA FOR ADMISSION

***Candidates must be able to satisfy the general admissions requirements of Glasgow Caledonian University***

***Programme Admission Requirements:***

- a) A minimum of a 2:2 honours degree of a UK university or equivalent which contains a substantial computing or information and communications technology component.

OR

- b) A formal qualification equivalent to (a) above.

OR

- c) Substantial experience in industry or commerce and supporting evidence of an ability to undertake a programme of study at postgraduate level.

AND

- d) A good knowledge of routing and switching technologies as evidenced by (c) above or appropriate industrial certification (for example Cisco CCNA certification or the ROUTE or SWITCH courses of Cisco CCNP certification) or interview.

- e) For students for whom English is not their first language

An IELTS average score of 6.0 and no element less than 5.5

OR

A TOEFL score of 550 (213 for Computer based test)

OR

An equivalent qualification

***Flexible Entry - Credit Transfer and RPL:***

No other Universities are teaching equivalent modules, however industry experience and prior learning may be taken into account when assessing an application to the programme.

***Entry with Advanced Standing:***

Not applicable.

**7. METHODS FOR EVALUATING AND IMPROVING THE QUALITY AND STANDARDS OF TEACHING AND LEARNING**

***• Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards:***

- Annual Programme Monitoring Process
- Annual Module Monitoring Process
- Module Feedback Questionnaire
- External Examiner(s) Reports
- Annual monitoring (required by Professional and/or Statutory Bodies)
- Enhancement-led Internal Subject Review (ELISR)
- Enhancement-led Institutional Review (ELIR)

***• Committees with responsibility for monitoring and evaluating quality and standards:***

- Student-Staff Consultative Group (SSCG)
- Programme Board (PB)
- School Board
- Assessment Board (AB)
- University Learning and Teaching Sub-Committee (LTSC)
- University Academic Policy Committee (APC)
- University Senate

***• Mechanisms for gaining student feedback on the quality of teaching and their learning experience:***

- Student-Staff Consultative Group (SSCG)
- Student representation on Programme Board (PB)
- Student representation on School Board
- Module Feedback Questionnaire
- GCULearn
- Open access to members of Programme Team e.g. Module Leaders, Programme Leader, Academic Advisor, Year Tutor

- **Staff development priorities include:**
  - Postgraduate Certificate in Learning and Teaching
  - Continuous Professional Development (CPD)
  - Performance and Development Annual Review (PDAR)
  - Peer support for teaching
  - Mentoring scheme for new teaching staff
  - Conference and seminar attendance and presentation
  - Research Excellence Framework (REF) submission
  - Membership of Higher Education Academy (HEA)
  - Membership of and involvement with Professional Bodies

## 8. ASSESSMENT REGULATIONS

Students should expect to complete their programme of study under the Regulations that were in place at the commencement of their studies on that programme, unless proposed changes to University Regulations are advantageous to students.

The Glasgow Caledonian University Assessment Regulations which apply to this programme, dependent on the year of entry and with the following approved exceptions can be found at : [GCU Assessment Regulations](#)

### ***Programme Specific Exceptions:-***

The MSc Advanced Internetwork Engineering programme is part of the Postgraduate Networking Programme Suite and subject to a specific regulation stating that a student must pass the Research and Project Methods module prior to progressing to the Dissertation (Case 52 – a minor approved exception to regulation 15.5 of the assessment regulations). The purpose of this exception is to ensure that students will have a satisfactory project proposal, which leads into the dissertation. The exception will continue to be utilised by all programmes in the suite.

## 9. INDICATORS OF QUALITY AND STANDARDS

The programme is subject to the University processes of regular programme review and to external assessment by academics in other UK Higher Education Institutions.

### ***Role of External Assessor:***

The duties of the External Assessor include the following:

- To moderate the work of the Internal Assessors in respect of the assessments under his/her jurisdiction.
- To attend Assessment Boards at which the results of a final stage assessment will be determined.
- To satisfy himself/herself that the work and decisions of the Assessment Board(s) are consistent with the policies and regulations of the University and best practice in higher education.
- To ensure that students are assessed within the regulations approved by the University for the programme and to inform the University on any matter which, in his/her view, militates against the maintenance of proper academic standards.

To report annually on the standards attained by students on the programme and on any other matters which may seem appropriate for report.

## 10. INFORMATION ABOUT THE PROGRAMME

Key information about the programme can be found in:

- Definitive Programme Document
- Programme Handbook
- Module Handbook
- University Website <http://www.gcu.ac.uk>
- School Website
- GCULearn
- My Caledonian
- University Prospectus

This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning assessment methods of each module can be found in the University Module catalogue which can be accessed from the University website. The accuracy of the information in this document is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

A curriculum map is attached showing how the outcomes are being developed and assessed within the programme. This relates the modules from Section 4 to the outcomes in Section 3.

DATE: **October 2019**

# Curriculum Map for MSc Advanced Internetwork Engineering

The curriculum map links the modules (Section 4) to the Outcomes listed in Section 3

This map provides both a design aid to help academic staff identify where the programme outcomes are being developed and assessed within the course. It also provides a checklist for quality assurance purposes and could be used in approval, accreditation and external examining processes. This also helps students monitor their own learning, and their personal and professional development as the course progresses. The map shows only the main measurable learning outcomes which are assessed. There are additional learning outcomes (e.g. attitudes and behaviour) detailed in the module specifications which are developed but do not lend themselves to direct measurement

Code	Title	Programme outcomes																										
		A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	D1	D2	D3	D4	E1	E2	E3	E4	E5	E6	
MMI122895	Layer 2 Technologies	X		X	X			X		X		X		X						X				X				X
MMI123707	Layer 3 Technologies I	X			X				X			X		X				X										
MMI123708	Layer 3 Technologies II	X		X	X	X						X		X				X						X		X		
MMI123709	Security and VPN Technologies	X			X	X				X				X	X	X		X										
MMI123710	Multicast and WAN Technologies	X			X	X				X				X							X							
MMI122898	Infrastructure Services	X			X						X			X				X										
MMI122899	Integrating Network Technologies		X	X		X					X			X				X						X	X	X		X
MMG412775	Research and Project Methods																	X						X	X	X		X
MMH212794	MSc Project																	X					X	X	X		X	X