

PROGRAMME SPECIFICATION

1	Awarding Institution	Newcastle University
2	Teaching Institution	Newcastle University
3	Final Award	MSc
4	Programme Title	Computer Security and Resilience
5	UCAS/Programme Code	5144
6	Programme Accreditation	British Computer Society
7	QAA Subject Benchmark(s)	Computing
8	FHEQ Level	M
9	Date written/revised	16/04/14

10 Programme Aims

1. To equip students with the skills and knowledge required to develop and assess secure and resilient computer-based systems
2. To provide a qualification enhancing employment prospects in dependable computing
3. To develop research skills
4. To develop and improve key skills in written and oral communication and in teamwork
5. To develop and improve skills in using the literature and information technology resources relevant to dependable computing
6. To encourage the development of creativity skills
7. To develop skills in critical assessment, analysis and storage of information
8. To provide a programme which meets the accreditation requirements of the appropriate professional bodies, thus providing a basis for further professional development and lifelong learning
9. To address the relevant professional, legal and ethical issues relevant to the development, assessment and maintenance of secure and resilient systems
10. To provide an international perspective on developments in computer security and resilience.
11. To provide a programme which meets the FHEQ at Masters level and takes appropriate account of the draft subject benchmark statements in Computing.

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. The programme outcomes have references to the benchmark statements for Computing.

Knowledge and Understanding

On completing the programme students should be able to demonstrate:

- A1 Understanding of the theory underpinning dependability, security and resilience in computer-based systems
- A2 Knowledge of advanced techniques for assessing information security
- A3 Knowledge of the major methods for assessing system resilience
- A4 Knowledge of the major fault tolerance techniques applicable in computing system design
- A5 Understanding of the technologies for the design of trustworthy interactive systems, including human error assessment
- A6 Understanding of the computer aided verification techniques relevant to security in distributed systems

A7 Understanding of the principles underlying high integrity software development using advanced static analysis and formal techniques
A8 Understanding of major professional, legal and ethical issues associated with work in secure and resilient computing systems
A9 Understanding of the international character of contemporary developments in security and resilience.

Teaching and Learning Methods

The primary method of imparting knowledge and understanding is lectures supported by practical work in classes and laboratories (A1-A9). Fundamental motivation (A1), is further reinforced through case study material describing real-world failures of security and resilience. Knowledge of leading technologies (A2-A6), is assisted through the practical laboratory work in addition to the lectures. Professional, legal and ethical issues (A8) are addressed explicitly in the dependability context and reinforced in the core technical modules and again in the group project. The international character of developments in the subject (A9) is emphasised in the research skills module and individual project. Through the many case studies underpinning studies in secure systems, Students will be encouraged to deepen understanding by independent reading in the relevant technical and scientific literature, supported by guidance in information literacy skills (in induction and prior to the group and individual projects) and subject-specific guidance given in lectures.

Assessment Strategy

Technical knowledge and understanding is primarily assessed through unseen written examinations (A1-9). In the case of major technical methods (A2-A6), assessment is also based on coursework based on practical exercises.

Intellectual Skills

On completing the programme students should:

- B1 Be able to propose, conduct and write up an extended research project involving, where appropriate, a literature review, problem specification, design, verification, implementation and analysis
- B2 Be able to design, implement and validate new software for secure or resilient applications
- B3 Be able to organise and take part in systematic dependability analyses of existing systems
- B4 Have expertise in the use and applicability of up-to-date software development tools
- B5 Be able to assess the main human factors relevant to secure system operation
- B6 Be able to apply the leading techniques for security in network and internet environments, including cryptography and public key infrastructures
- B7 Be able to apply the major methods for assessing system resilience
- B8 Be able to deploy fault tolerance appropriately in system design

Teaching and Learning Methods

Intellectual skills are imparted through lectures on research project planning (B1) and through one-to-one and small group supervisions during the individual project. Specific design, validation skills (B2,B4,B6,B8) are introduced in practical classes. Assessment skills (B3,B5,B7) are introduced through practical case studies in taught modules. Throughout the programme, the emphasis is on skills development through practical experience. Students are encouraged to acquire relevant skills through: the group and individual projects, which have a research element (B1); individual modules' laboratory classes in design (B2,B4,B6,B8), and dependability assessment methods (B3,B5,B7). The group project aims to encourage students to learn how skills specific to sub-disciplines (B2-B7) interact in design and assessment.

Assessment Strategy

Intellectual skills are primarily assessed by means of reports, designs and software developed by students in coursework activities and private study (B6-B8). The individual project deliverables (proposal, presentation and dissertation) are the main vehicles for assessment of B1. Reports from individual and group projects are used for assessment of B2, B4, B5. For B6-B8, assessment is based on project reports from coursework supplemented by focussed problems in unseen written examinations.

Practical Skills

On completing the programme students should be able to:

- C1 Critically evaluate research and literature relating to security and resilience of computer-based systems
- C2 Evaluate and use appropriate tools and techniques
- C3 Undertake critical evaluation (theoretical and empirical) of alternative solutions
- C4 Solve design problems

Teaching and Learning Methods

Practical skills are developed through practical study skills sessions in information research and literacy (C1) and practical design classes as part of the practical component of each module (C2,3,4). Students are encouraged to acquire these skills through preparing seminars and presentations on current topics in computer security and resilience (C1), through the preparation and presentation of design and tooling alternatives in practical classes and the group project (C2,3,4)

Assessment Strategy

Practical skills are primarily assessed through practical work. C1 is assessed through specific coursework exercises, a seminar and dissertation at the end of the individual project. C2-C4 are primarily assessed in individual and group-based coursework and the final project. C3 and C4 are also assessed, in part, via unseen written examinations.

Transferable/Key Skills

On completing the programme students should have:

- D1 The ability to communicate orally in a professional context
- D2 Written communication skills, including an appreciation of the role of peer review of papers, software, proposals and other research and development products
- D3 Information literacy skills, including the ability to use computer-based resources for research in the professional literature and the capacity to undertake critical review
- D4 The ability to work as part of a team, including group-based learning, research and development activity
- D5 Creativity skills: recognising and responding to opportunities for innovation
- D6 Planning and organisation skills

Teaching and Learning Methods

Communication skills (D1,D2) are imparted through seminars on oral presentation and technical writing within the module on research skills, the group and individual projects. Skills in computer-based information resources (D3) are promoted through specialist classes provided in conjunction with the Robinson Library's Information Literacy programme. Team working skills (D4) are developed in the group project module through introductory lectures on team working issues and guidance during the project. Creativity skills are introduced in practical classes, as well as the group and individual projects. Planning and organisation skills (D6) are stressed throughout the practical aspects of the programme, notably in the preparation for the group and individual projects.

Students are encouraged to practise communication skills (D1) through group working, informal and formal presentations, and through written reports associated with practical exercises, the group and individual project (D2). Skills in using computer-based information resources (D3) are encouraged by research-related exercises. Team working skills (D4) are practised through students collaborating in a major team-based project. Creativity skills (D5) are encouraged by tackling design problems which grow in the level of challenge, from specialised technical modules to group and individual projects.

Assessment Strategy

Key skills are primarily assessed through practical work (D1-D6). D1 is assessed by means of student presentations following practical work involving research and literature review, in the group and individual projects. D2 and D3 are assessed via reports submitted as parts of coursework and project work, including a specific research skill module, as well as the final dissertation. D4-D6 is assessed primarily via observation of teams during the group project. D5 and D6 are additionally assessed by observation during the individual project.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

The programme is studied over one year full time. There is a single stage to the programme, requiring the study of 180 credits. A 10 credit module consists of 100 hours of student effort, covering lectures, practical classes, small group teaching and private study, completion of coursework and revision. Most modules vary in size from 5 credits to 15 credits. There is one 90-credit module containing the individual project.

The programme is divided into three phases. Phase 1 lays foundations in the principles of computer security and resilience (A1, A3, A4) and follows this with material on specialist sub-disciplines which develop core technical knowledge (A1-A6) and also introduce professional (A7) and subject-specific skills through their practical and coursework components (B2-B8). This phase is composed of six 10-credit modules in Semester 1.

Phase 2 integrates the material covered in the sub-disciplines by giving a thorough grounding in the technology of high integrity software development and systems assessment. Some practice-related knowledge is introduced at this stage (A7,A8) but the emphasis is on developing professional and cognitive skills. Design and dependability evaluation skills are developed in a module focussed on high-integrity development processes and tools (B2-B4) while essential research and communication skills (C1, D1-D3) are explicitly developed in a seminar-based module on topics of current research interest with a strong international emphasis (A9). A group project module is a major way of developing professional skills in development and evaluation (B3-B5, B7, B8) and cognitive skills relating to design and tools selection (C2-C4). Team working skills (D4) are explicitly developed. Other key skills in communication are developed through oral and written reporting (D1, D2) on planning and design activities in the project (D5, D6). This phase is composed of 30 credits in three modules in Semester 2.

Phase 3 of the programme emphasises research skills, creativity and management of independent work through a substantive research-related project selected by the student in consultation with an academic supervisor. It consists of an initial phase in which students are given further training in cognitive and key skills (C1, D2, D3, D6) essential to the management of an individual research-related project, culminating the production of an assessed research proposal. The execution of the project concentrates on the development of specific subject skills in the chosen project area (B1, B4, B7, B8), higher cognitive and key skills (C2, C3, C4, D2, D5, D6). This phase commences in Semester 2 and carries on to the end of the programme.

Duration: 1 year

Stages: 1

Credits: 180

Module credits:

All modules are compulsory

Semester 1: 6 modules, each 10 credits

Semester 2: 3 modules: 10 + 5 + 15 credits, followed by

Project: 90 credits, beginning half way through semester 2.

Key features of the programme (including what makes the programme distinctive)

Subject to agreement with industry, the project work can be undertaken with a sponsoring company.

Modules in the first semester are taught in intensive mode.

Programme regulations (link to on-line version)

<http://www.ncl.ac.uk/regulations/programme/>

13 Criteria for admission

Entry qualifications

Good Honours degree (2.2 or above) or equivalent in Computing Science, Software Engineering or a discipline with a significant computing component (e.g. Engineering including Systems Engineering, Mathematics).

Admissions policy/selection tools

Applicants with non-standard qualifications may be interviewed.

Non-standard Entry Requirements

Science and Engineering graduates with several years' industrial experience will also be considered. Holders of professional qualifications in computing (e.g. MBCS) will also be considered.

Additional Requirements

None

Level of English Language capability

For applicants whose first language is not English we ask for IELTS 6.5 or TOEFL 233 (computer-based).

14 Support for Student Learning

The Student Services portal provides links to key services and other information and is available at: <http://www.ncl.ac.uk/students/>

Induction

During the first week of the first semester students attend an induction programme. New students will be given a general introduction to University life and the University's principle support services and general information about the School and their programme, as described in the Degree Programme Handbook. New and continuing students will be given detailed programme information and the timetable of lectures/practicals/labs/ tutorials/etc. The International Office offers an additional induction programme for overseas students.

Study skills support

Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined in the Programme Specification. Some of this material, e.g. time management is covered in the appropriate Induction Programme. Students are explicitly tutored on their approach to both group and individual projects.

Numeracy support is available through Maths Aid and help with academic writing is available from the Writing Development Centre (further information is available from the Robinson Library).

Academic and Pastoral support

Each undergraduate and taught postgraduate student will be assigned a personal tutor.* A personal tutor is one part of a wider network of advice and guidance available to students to support their personal and general academic development. The module leader acts as the first point of contact for subject-specific academic advice. Thereafter the Degree Programme Director or Head of School may be consulted. Issues relating to the programme may be raised at the Student-Staff Committee, and/or at the Board of Studies. Within the academic unit, students may also receive additional academic and pastoral advice from a range of other student-facing staff including degree programme directors, dissertation/project supervisors, and administrative support staff.

*Arrangements may vary for students taking special types of provision.

The University also offers a wide range of institutional services and support upon which students can call, such as the Writing Development Centre, Careers Service and Student Wellbeing Service. This includes one-to-one counselling and guidance or group sessions / workshops on a range of topics, such as emotional issues e.g. stress and anxiety, student finance and budgeting, disability matters etc. There is specialist support available for students with dyslexia and mental health issues. Furthermore, the Student Union operates a Student Advice Centre, which can provide advocacy and support to students on a range of topics including housing, debt, legal issues etc.

Support for students with disabilities

The University's Disability Support team provides help and advice for disabled students at the University - and those thinking of coming to Newcastle. It provides individuals with: advice about the University's facilities, services and the accessibility of campus; details about the technical support available; guidance in study skills and advice on financial support arrangements; a resources room with equipment and software to assist students in their studies.

Learning resources

The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), and Information Systems and Services, which supports campus-wide computing facilities.

The School of Computing Science has well equipped computer laboratories consisting of networked PCs. Key software used in the support and delivery of the programme is available to students free of charge.

All new students whose first language is not English are required to take an English Language Proficiency Test. This is administered by INTO Newcastle University Centre on behalf of Newcastle University. Where appropriate, in-session language training can be provided. The INTO Newcastle University Centre houses a range of resources which may be particularly appropriate for those interested in an Erasmus exchange.

15 Methods for evaluating and improving the quality and standards of teaching and learning

Module reviews

All modules are subject to review by questionnaires which are considered by the Board of Studies. Changes to, or the introduction of new, modules are considered at the Board of Studies and/or the School Teaching and Learning Committee. Student opinion is sought at the Student-Staff Committee and/or the Board of Studies. New modules and major changes to existing modules are subject to approval by the Faculty Learning, Teaching and Student Experience Committee.

Programme reviews

The Board of Studies conducts an Annual Monitoring and Review of the degree programme and reports to Faculty Learning, Teaching and Student Experience Committee. The FLTSEC takes an overview of all programmes within the Faculty and reports any Faculty or institutional issues to the Faculty Learning, Teaching and Student Experience Committee.

External Examiner reports

External Examiner reports are considered by the Board of Studies. The Board responds to these reports through Faculty Learning, Teaching and Student Experience Committee. External Examiner reports are shared with institutional student representatives, through the Student-Staff Committee.

Student evaluations

All modules, and the degree programme, are subject to review by student questionnaires. Informal student evaluation is also obtained at the Student-Staff Committee, and the Board of Studies. The results from student surveys are considered as part of the Annual Monitoring and Review of the programme and any arising actions are captured at programme and School / institutional level and reported to the appropriate body.

Mechanisms for gaining student feedback

Feedback is channelled via the Student-Staff Committee and the Board of Studies.

Faculty and University Review Mechanisms

Every six years degree programmes in each subject area undergo periodic review. This involves both the detailed consideration of a range of documentation, and a review visit by a review team (normally one day in duration) which includes an external subject specialist and a student representative. Following the review a report is produced, which forms the basis for a decision by University Learning, Teaching and Student Experience Committee on whether the programmes reviewed should be re-approved for a further six year period.

Accreditation reports

The BCS have approved this programme for accreditation for CITP Further Learning Element, CEng/Csci (Partial Fulfilment).

Additional mechanisms

None.

16 Regulation of assessment

Pass mark

The pass mark is 50

Course requirements

Progression is subject to the University's Masters Degree Progress Regulations, Taught and Research and Examination Conventions for Taught Masters Degrees. There are reassessment opportunities, with certain restrictions. Limited compensation up to 40 credits of the taught element and down to a mark of 40% is possible for candidates who commenced their programme in 2013/14 or earlier. For students starting their programme in 2014/15 or later, no compensation is possible.

Common Marking Scheme

The University employs a common marking scheme, which is specified in the Taught Postgraduate Examination Conventions, namely:

Summary description applicable to postgraduate Masters programmes

<50	Fail
50-59	Pass
60-69	Pass with Merit
70 or above	Pass with Distinction

Summary description applicable to postgraduate Certificate and Diploma programmes

<50	Fail
50 or above	Pass

Role of the External Examiner

An External Examiner, a distinguished member of the subject community, is appointed by Faculty Learning Teaching and Student Experience Committee, after recommendation from the Board of Studies. The External Examiner is expected to:

- See and approve examination papers
- Moderate examination and coursework marking
- Attend the Board of Examiners
- Report to the University on the standards of the programme

In addition, information relating to the programme is provided in:

The University Prospectus: <http://www.ncl.ac.uk/postgraduate/>)

The School Brochure: <http://www.ncl.ac.uk/computing/>

The University Regulations: <http://www.ncl.ac.uk/regulations/docs/>)

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

Mapping of Intended Learning Outcomes onto Curriculum/Modules

Intended Learning Outcome	Module codes (Compulsory in Bold)
A1	CSC8102, CSC8201
A2	CSC8102, CSC8202
A3	CSC8105, CSC8201
A4	CSC8201
A5	CSC8203
A6	CSC8105
A7	CSC8204, CSC8404, CSC8406
A8	CSC8201, CSC8202, CSC8205, CSC8206
A9	CSC8205
B1	CSC8205, CSC8299
B2	CSC8204, CSC8404, CSC8406
B3	CSC8204, CSC8206
B4	CSC8204, CSC8206, CSC8299, CSC8404, CSC8406
B5	CSC8203, CSC8206
B6	CSC8102, CSC8202
B7	CSC8105, CSC8206, CSC8299
B8	CSC8206, CSC8299
C1	CSC8205, CSC8299
C2	CSC8206, CSC8299, CSC8404, CSC8406
C3	CSC8204, CSC8206, CSC8299
C4	CSC8204, CSC8206, CSC8299
D1	CSC8206, CSC8299
D2	CSC8102, CSC8105, CSC8201, CSC8202, CSC8203, CSC8205, CSC8206, CSC8299
D3	CSC8205, CSC8299
D4	CSC8206
D5	CSC8204, CSC8206, CSC8299, CSC8404, CSC8406
D6	CSC8206, CSC8299