

## PROGRAMME SPECIFICATION

This document describes the **Master of Science, Master of Science with a Year in Industry, Postgraduate Diploma, and Postgraduate Certificate in Information Security**. This specification is valid for new entrants from **September 2017**.

The aims of this programme are:

- provide advanced study of the technical, legal and commercial aspects of information security supported by research staff and recognised security experts from industry;
- examine critically current strategies, methodologies and techniques in information security;
- examine the main security issues in the development of digital business activities;
- develop a critical awareness of current problems in information security together with strategies and countermeasures for addressing these;
- relate the academic study of security to matters of public concern;
- develop the subject-specific and generic skills and techniques that will facilitate progression to MPhil/PhD studies in information security or a related field;
- develop the written presentation skills needed for the effective communication of security-related findings at advanced level;
- foster the ability to learn independently, whether for career enhancement, progression to research, or personal intellectual development;
- provide a strong foundation for a professional career as a security expert in business or commerce.

This programme is offered by the Royal Holloway Information Security Group (ISG), which is an interdisciplinary research group of computer scientists, mathematicians and sociologists. It is one of the largest academic groups of security researchers in the world and all members of the group have strong links with external organisations involved with information security and secure digital business, including many of the largest such organisations in the country. The programme provides students with a systematic understanding and critical awareness of current threats to the security of electronic information and the measures available to counteract these. To ensure that this programme is at the forefront of developments in information security, several of the courses involve significant input from recognised security experts in industry and commerce. The programme will include study of a range of technologies such as cryptography, computer security and fraud detection as well as considering the management of security and the many trade-offs and subjective issues that need to be addressed when implementing information security within an organisation. It will also develop the discipline-specific and transferable skills required for a professional career and for postgraduate research in information security.

The Year in Industry programme further enables students to gain industrial experience (which enhances their employability) and acquire skills that can only be fully acquired in a work environment. It also allows students to develop a better appreciation of how their learning objectives relate to real-world problems or situations, and to put into practice the knowledge that they will have acquired during their studies.

The programme can be studied full-time over one year (Normal Full-time) and also part-time over two years (Normal Part-time). In addition to this, students can study the MSc over a period of between 3 and 5 years via part-time Continuing Professional Development Mode (CPD Part-time).

The MSc Information Security with a Year in Industry programme is delivered in a single stage, equating to up to two years of full-time study including an industrial placement. This programme is not available in part-time mode.

The MSc consists of a **core** element (contributing four ninths of the total assessment of the degree) made up of four taught courses, an **options** element (two ninths of the assessment) comprising two courses selected from a choice of courses, and a research **project** (three ninths of the assessment). The core element has two different forms, the selection of which depends on the interests and background of the student and their likely future career. Both forms of the core involve four taught courses.

Students may opt to also register for an MSc **Pathway** (also referred to as a track), the choice of which will limit their choices with respect to all three elements of the degree programme, i.e. the core, the options, and the project. Successful completion of an MSc pathway will indicate that the student has achieved a degree in a specialist sub-area within Information Security, and this will be acknowledged on the degree transcript. There are 6 possible pathways:

- Cybercrime
- Smart cards and RFID/NFC
- Cyber security
- Security testing
- Digital forensics
- Secure Digital Business

The PG Dip and PG Cert are exit awards for students that obtain 120 and 60 credits respectively. The allocation of credits is described below.

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This document provides a summary of the main features of the programme(s), and of the outcomes which a student might reasonably be expected to achieve if full advantage is taken of the learning opportunities provided. Further information is contained in the College prospectus, the College Regulations and in various handbooks issued to students upon arrival. Whilst Royal Holloway keeps all its information for prospective applicants and students under review, programmes and the availability of individual courses are necessarily subject to change at any time, and prospective applicants are therefore advised to seek confirmation of any factors which might affect their decision to follow a specific programme. In turn, Royal Holloway will inform applicants and students as soon as is practicable of any substantial changes which might affect their studies.

### **Learning outcomes**

Teaching and learning in the programme are closely informed by the active research of staff. In general terms, the programme provides opportunities for students to develop and demonstrate the following learning outcomes:

*Knowledge and understanding:*

- the essential concepts, methods and approaches of information security;
- the main security issues in the development of digital business activities;
- the technical, legal and commercial issues that need to be addressed when assessing the information security needs of an organisation;
- the organisational and personal issues that need to be addressed when implementing information security within an organisation;

- the potential sources of vulnerability within an information system and the possible implications of failing to counter these with adequate security controls;
- the appropriate countermeasures to information security threats and the likely implications of their adoption;
- the relevance and impact of new developments in information security threats, technologies and controls.

*Skills and other attributes:*

- analysing and evaluating critically the ways in which organisations manage their information security;
- identifying and assessing threats to information security within an organisation;
- applying the concepts, approaches and techniques of information security to particular problems;
- devising effective measures to address information security threats within an organisation;
- examination of complex problems and the formulation of sound judgements on the basis of incomplete data;\*
- planning and executing an independent, original and extended project into a specific aspect of information security;
- reflecting critically on the results of research investigations and the methods used to obtain these;\*
- producing a clear, comprehensive, and critically evaluative report of an independent research project in the form of a dissertation;
- conveying (in writing) the results of research clearly and systematically in a manner comprehensible to the non-specialist;\*
- making productive use of libraries, the Internet and other useful sources of information;\*
- engaging in productive intellectual discussion and debate with peers and members of staff;\*
- acting autonomously and co-operating with others in planning and implementing tasks;\*
- independent learning and scholarship necessary for continuing professional development;\*
- In addition to the above skills, the programme fosters the development of a range of personal attributes. These include: personal motivation; the ability to work, as appropriate, both autonomously and with others; self-awareness and self-management; intellectual integrity; flexibility, adaptability; and creativity.\*

\* transferable skills

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### **Teaching, learning and assessment**

The interest and enthusiasm of students are nurtured through their close involvement with research-active academic staff of the Information Security Group and security experts from industry and commerce. Methods used to develop knowledge, understanding and skills will vary slightly with different courses. A variety of techniques are used including lectures, face-to-face discussions, practical demonstrations, the Moodle Virtual Learning Environment, exercise sheets, small-group and individual tutorials, and guided independent study and research. The ISG website also provides independent learning materials, bibliographies and links to other resources. Students are expected to attend all the required lectures, tutorials, and attempt all exercise sheets.

Discipline-specific and transferable skills are developed throughout the programme. The four core courses introduce students to the various ways in which different organisations solve problems of security management and how computer systems are made secure. Building on the core courses, the optional courses introduce a wider range of techniques and assess their suitability for specific roles. Research skills are developed to a professional level through the design, execution and written report of an independent research project, which also serves to integrate knowledge and skills acquired throughout the programme.

Final assessment of knowledge, understanding and skills is by six unseen, written examinations and (for the MSc) a dissertation. The majority of the courses also include coursework, that does not contribute marks towards the final award but which students should complete. Two of the courses have coursework that **does** contribute towards the final award (namely Introduction to Cryptography and Security Mechanisms and also Software Security). Full details of the assessments for individual courses can be obtained from the [ISG web site](#).

The Information Security Group and the Careers Service organise a programme of events (such as seminars and training sessions) aimed at helping students find and secure placements. Students registered for the MSc in Information Security with a Year in Industry are expected to attend all events within this programme. Failure to engage fully with the programme may lead to students being transferred to the normal MSc in Information Security degree.

Students registered for the MSc in Information Security with a Year in Industry who have not met the criteria for progression to the year in industry or have not been able to secure a placement are transferred to the normal MSc in Information Security programme.

The **Industrial Placement** is only available to the eligible Year in Industry students, and takes up to one year, starting at the end of the Summer term (approximately at the beginning of July). At the end of the placement, the student produces a Placement Report, which is submitted and assessed in conjunction with the individual Project Report. Details of the industrial placement are available from the placement handbook on the [ISG web site](#).

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## Details of the programme structure(s)

### A. *Core Element*

MSc students must select one of two possible forms for the core of the degree:

#### Core A

Students must take the following mandatory courses:

- (i) IY5501: Security Management (20 credits)
- (ii) IY5502: Introduction to Cryptography and Security Mechanisms (20 credits)
- (iii) IY5511: Network Security (20 credits)
- (iv) IY5512: Computer Security (Operating Systems) (20 credits)

#### Core B

Students must take the following mandatory courses:

- (i) IY5501: Security Management (20 credits)
- (ii) IY5502: Introduction to Cryptography and Security Mechanisms (20 credits)
- (iii) IY5523: Secure Business Architectures (20 credits)
- (iv) IY5522: Security Technologies (20 credits)

### B. *Options Element,*

Students must select two optional courses (to the value of 40 credits):

- (i) IY5521: Legal and Regulatory Aspects of Information Security (20 credits)
- (ii) IY5603: Advanced Cryptography (subject to availability) (20 credits)
- (iii) IY5604: Database Security (20 credits)
- (iv) IY5605: Cyber Crime (20 credits)
- (v) IY5606: Smart Cards, RFIDs and Embedded Systems Security (20 credits)
- (vi) IY5607: Software Security (20 credits)
- (vii) IY5609: Digital Forensics (20 credits)
- (viii) IY5610: Security Testing Theory and Practice (20 credits)
- (ix) IY5612: Cyber Security (20 credits)
- (x) IY5613: Human Factors of Security and Privacy (20 credits)

### C. *Project Element*

Students must take the Project element:

IY5500: Project (60 credits) non-condonable

For normal MSc students, all of the marks for this element come from the dissertation.

For Year in Industry MSc students, 90% of the marks for this element come from the dissertation, and 10% from the Placement Report.

#### **D. Pathways.**

An MSc student may optionally register for one of the following six pathways. These constrain the choices of the student in the following ways.

| <b>Pathway</b>           | <b>Core</b>      | <b>Mandatory Options</b> | <b>Project</b>  |
|--------------------------|------------------|--------------------------|---|
| Cybercrime               | Core A           | IY5605 and IY5609        | Related to cybercrime                                     |
| Smart cards and RFID/NFC | Core A           | IY5606                   | Related to smart cards, RFID/NFC embedded systems and IoT |
| Cyber security           | Core A or Core B | IY5612                   | Related to cyber security                                 |
| Security testing         | Core A           | IY5610                   | Related to security testing                               |
| Digital forensics        | Core A           | IY5609                   | Related to digital forensics                              |
| Secure Digital Business  | Core B           | IY5521                   | Related to secure digital business                        |

#### **Study Cycle**

**Full-time students** take the four mandatory courses from either Core A or B in the Autumn term and two optional courses in the Spring term. MSc students (including Year in Industry students) are allocated project supervisors towards the end of the Autumn term, and commence work on their independent project at the start of the Spring term.

**Normal Part-time Students (two year programme)** usually attend one day per week during term time (“day-release”). In the first year they normally take two of the four mandatory courses from either Core A or B in the Autumn term. The remaining mandatory courses are normally taken in the Autumn term of the second year. Students can take the optional courses either in their first year or their second year or in both years. Alternatively, students can attend a **subset** of the above courses in block mode. MSc students will normally do the independent project during their second year.

**CPD Part-time Students** study for the MSc over a (minimum) period of three years, and a maximum period of five years. CPD Part-time students will accumulate credits towards the MSc by studying one or more ISG-delivered courses (and sitting the appropriate exams on campus) each year. Specific courses can be studied either through the normal day release scheme or through block mode. MSc students will normally do the independent project during their final year. Note that credits gained from the Distance Learning (DL) programme can also be used for credit transfer purposes. Credit from DL (or other universities) may be granted only in up to the first two thirds of the MSc programme.

Note that not all courses are delivered in block mode and that the block mode courses operate on a two-year cycle. Furthermore **only Core A can be completed through block mode**. Block mode courses available in the current academic year can be obtained from the [ISG web site](#).

#### **Assessment Details and Dates**

The mandatory *Core* element (total of four courses or 80 credits) contributes four ninths toward the final award of the MSc. The *Options* element (total of two courses) contributes two ninths toward the final award of the MSc. The *Project* for the compulsory project element contributes three ninths toward the final award of the MSc.

The courses that comprise the Core and Option elements are all assessed by two-hour written examination papers. Furthermore, some of the coursework from IY5502 and IY5607 contributes towards the final award. For the Options element, students must sit two options exams. Full-time students take all examination papers in the Summer term. Part-time students normally take two core examination papers in the Summer term of their first year and the remaining two core exams in the Summer term of their second year. The options exams can be taken in the Summer term of the first year or the second year (or both).

The project submission date is during Week 49 of the academic year (this always falls right at the end of August). Part-time MSc students will normally submit their projects at the end of their final year of studies. The project submission date for Year in Industry students is Week 49 of their second year of studies.

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### **Progression Requirements for the Year in Industry**

The decision on progression to the year in industry is taken by the examination sub-board. Normally, to progress to the year in industry a student must:

- Engage with the activities run by the Careers service throughout the year
- Achieve at least 50% in the January placement test
- Engage with the project process during the Autumn and Spring term, and submit mandatory project process paperwork by the required deadlines
- Pass each of the six taught courses
- Show competence in the use of English language within the January placement test

### **Progression and award Requirements**

Progression throughout the year/s is monitored through performance in oral presentations, contributions to seminar discussion and coursework.

Please note that if you hold a Tier 4 (General) Student Visa and you choose to leave (or are required to leave because of non-progression) or complete early (before the course end date stated on your CAS), then this will be reported to UKVI.

To pass the **Masters** programme a student must achieve an overall weighted average of at least 50.00%. Failure marks between 40-49% can be condoned in courses which constitute up to a maximum of 40 credits, provided that the overall weighted average is at least 50.00%, but a failure mark (i.e. below 50%) in the dissertation cannot be condoned. A mark of less than 40% in **any** of the courses cannot be condoned.

The Masters degree with Merit may be awarded if a student achieves an overall weighted average of 60.00% or above, with no mark in any course which counts towards the final assessment falling below 50%. A Merit will not normally be awarded if a student re-sits or re-takes any course of the programme.

The Masters degree with Distinction may be awarded if a student achieves an overall weighted average of 70.00% or above, with no mark in any course which counts towards the final assessment falling below 50%. A Distinction will not normally be awarded if a student re-sits or re-takes any course of the programme.

The **Postgraduate Diploma** may be awarded if a student achieves an overall weighted average of at least 50.00%, with no mark in any taught course which counts towards the final assessment falling below 50% *and* has either chosen not to proceed to the dissertation, or has failed the dissertation on either the first or second attempt.

Failure marks in the region 40-49% are not usually condoned for the award of a Postgraduate Diploma, but if they are, such condoned fails would be in courses which do not constitute more than 40 credits.

The Postgraduate Diploma with Merit may be awarded if a student achieves an overall weighted average of 60.00% or above, with no mark in any course which counts towards the final assessment falling below 50%.

The Postgraduate Diploma with Distinction may be awarded if a student achieves an overall weighted average of 70.00% or above, with no mark in any course which counts towards the final assessment falling below 50%. A Distinction will not normally be awarded if a student re-sits or re-takes any course.

The **Postgraduate Certificate** may be awarded if a student passes three courses (i.e. achieves at least 50% in each of the three courses). Failure marks in the region 40-49% are not usually condoned for the award of a Postgraduate Certificate.

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### **Student support and guidance**

- An Induction Meeting at the beginning of the Autumn Term provides students with an introduction to the programme, the Information Security Group and the College in general
- Detailed PG handbook and course booklets.
- Several courses include small-group tutorials. Additional tutorials are also available during the first term for any students needing to consolidate their background knowledge in basic maths for cryptography
- All students are allocated a personal adviser, who will see their students at regular intervals, typically once a term, throughout the programme and are also available for consultation at advertised office hours
- For the MSc with year in industry, the personal advisor will also act as the placement adviser and will be the student's point of contact and support during the placement.
- Representation on the Staff-Student Committee.
- All ISG tutors are available for consultation by their students at advertised office hours
- All MSc students are allocated a supervisor for their research project (PG Dip and PG Cert students do not have such a supervisor)
- A dedicated network of workstations, accessible on a twenty-four hours per day/seven days per week basis, enables students to perform security-specific investigations. Students also have 24/7 access to the PCs in the College Computer Centre and free access to the Internet, including web browsers, file transfer and electronic mail
- Many of the courses which make up the programme have dedicated websites (typically through Moodle) which include learning materials and booklists
- Extensive supporting materials and learning resources in College and University libraries, as well as the Computer Centre
- College Careers Service and Departmental Employability Lead officer.
- Access to all College and University support services, including Student Counselling Service, the Centre for the Development of Academic Skills, Health Centre and Disability and Dyslexia Services (DDS).

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### **Admission requirements**

For details of admissions requirements please refer to the [Course Finder](#).

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## Further learning and career opportunities

This programme is intended primarily as a foundation for a professional career in information security, a field which has grown very rapidly in recent years. Graduates of this degree are well prepared for employment in both industry and commerce as security experts, the demand for which is likely to be very high for the foreseeable future. Successful completion of the programme will also provide a strong basis for postgraduate research in information security or related areas.

The International Information Systems Security Certification Consortium, (ISC)<sup>2</sup>, a non-profit organisation concerned with training and certifying information security professionals worldwide, offers current and ex-students on the MSc programme a two-day CISSP review seminar. Students are then allowed to sit for the CISSP exam and, upon passing, can be granted 'Associate' status until such time as they are eligible to apply for full CISSP certification.

The programme is linked to the university "Passport" scheme which recognises extra-curricular student activities and responsibilities that enhance their employability.

For more details on further learning and career opportunities please refer to the [Careers Service](#).

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## Indicators of quality and standards

The design and delivery of the MSc/PG Dip/PG Cert programme in Information Security draws extensively upon the research activities and expertise of staff of the Information Security Group (ISG). The ISG is one of the largest academic groups of security researchers in the world and all members of the group have strong links with external organisations involved with information security and secure electronic commerce, including many of the largest such organisations in the country. In August 2014, Royal Holloway was one of only four universities to have their MSc fully certified by GCHQ. The ISG is an Academic Centre of Excellence in Cyber Security Research. It also hosts one of only two EPSRC-funded Centres for Doctoral Training in Cyber Security.

Royal Holloway's position as one of the UK's leading research-intensive institutions was confirmed by the results of the most recent Research Excellence Framework (REF 2014) conducted by the Higher Education Funding Council (HEFCE). The scoring system for the REF 2014 measures research quality in four categories, with the top score of 4\* indicating quality that is world-leading and of the highest standards in terms of originality, significance and rigour and 3\* indicating research that is internationally excellent. 81% of the College's research profile was deemed to be within the 4\* or 3\* categories, an increase of over 20% since 2008. This results for the quality of our research outputs placed Royal Holloway 15<sup>th</sup> in the UK based on an overall Grade Point Average (GPA) score and 20<sup>th</sup> in the UK for 4\* and 3\* research. The Department of Mathematics is ranked 18 in the UK for research of a 4\* standard and 5 for 3\* and 4\* research and within the top 5 departments for their subject in the UK.

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## List of programmes

The programmes are taught entirely by staff at Royal Holloway, University of London, and the Masters leads to an award of the University of London. The Postgraduate Diploma and Postgraduate Certificate lead to an award of Royal Holloway and Bedford New College. The MSc in Information Security is certified by GCHQ. The Banner programme codes are given in parentheses.

## Master of Science Programme in Information Security

MSc in Information Security (1221)

## Master of Science Programme in Information Security with a Year in Industry



MSc in Information Security with a Year in Industry (2956)

**Postgraduate Diploma in Information Security**

PG Diploma in Information Security (2304)

**Postgraduate Certificate in Information Security**

PG Certificate in Information Security (2681)

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