ROYAL HOLLOWAY
University of London

PROGRAMME SPECIFICATION

This document describes the **Master of Science, Postgraduate Diploma, and Postgraduate Certificate in Information Security**. This specification is valid for new entrants from **September 2013**.

The aims of this programme are to:
- 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 modules 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 programme can be studied full-time over one year, two years part-time, or up to seven years part-time via Continuing Professional Development Mode ("CPD Mode").

The MSc consists of a core element (contributing 50% of the total assessment of the degree) made up of four taught modules, an options element (25%) comprising two modules selected from a choice of modules, and a research project (25%). 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 **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 track 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 tracks:

Cybercrime
Smartcards 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.

Further information
Learning outcomes
Teaching, learning and assessment
Details of the programme structure(s)
Award requirements

Student support and guidance
Admission requirements
Further learning and career opportunities
Indicators of quality and standards
List of programmes, with details of awards, degree titles, accreditation and teaching arrangements

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 modules 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 of the Royal Holloway Information Security Group, particularly in the areas of information security management, network security, systems security and cryptography. 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

Back to top

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 modules. A variety of techniques are used including lectures, face-to-face discussions, practical demonstrations, ISG website discussion board, 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 and attempt all exercise sheets.

Discipline-specific and transferable skills are developed throughout the programme. The four core modules 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 modules, the optional modules 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 (or optionally seven) unseen, written examinations and (for the MSc) a dissertation. The majority of the modules also include coursework, that does not contribute marks towards the final award but which students should complete. Full details of the assessments for individual modules can be obtained from the ISG web site.

Back to top

Details of the programme structure
A. Core Element
MSc students must select one of two possible forms for the core of the degree:

Core A, IY5510
Students must take the following four modules:

Code	Title
IY5501	Security Management
IY5502	Introduction to Cryptography and Security Mechanisms
IY5511	Network Security
IY5512	Computer Security

Core B, IY5520
Students must take the following four modules:

Code	Title
IY5501	Security Management
IY5502	Introduction to Cryptography and Security Mechanisms
IY5523	Secure Business Architectures
IY5522	Security Technologies

***B. Options Element*, IY5600**

Students must select **two** (or optionally **three**) of the following modules:

Code	Title
IY5521	Legal and Regulatory Aspects of Electronic Commerce
IY5603	Advanced Cryptography
IY5604	Database Security
IY5605	Cyber Crime
IY5606	Smart Cards/Tokens Security and Applications
IY5607	Software Security
IY5609	Digital Forensics
IY5610	Security Testing Theory and Practice
IY5612	Cyber Security

C. *Project Element*, **IY5500**

MSc students take the following compulsory element:

Code	Title
IY5500	Project

D. *Tracks*

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

Track	Core	Mandatory Options	Project
Cybercrime	Core A	IY5605 and IY5609	Related to cybercrime
Smartcards and RFID/NFC	Core A	IY5606	Related to smartcards or RFID/NFC
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

D. *Credits*

An individual module exam that is passed at the 50% level is worth 20 credits. A Core element that is passed at the 50% level is worth 80 credits. An Options element that is passed at the 50% level is worth 40 credits. A Project passed at the 50% level is worth 60 credits.

Full-time students take the four core modules in the Autumn term and two (or optionally three) option modules in the Autumn or Spring term (MSc students then proceed to the independent project).

Part-time students normally attend one day per week during term time ("day-release"). In the first year they normally take two of the four core modules in the Autumn term. The remaining core modules are normally taken in the Autumn term of the second year. Students can take the options modules either in their first year or their second year or in both years. Alternatively, students can attend any of the available block mode modules. MSc students will normally do the independent project during their second year. However, students are allowed to do the project during their first year.

CPD students study for the MSc over a (minimum) period of three years, and a maximum period of seven years. CPD Mode students will accumulate credits towards the MSc by studying one or more ISG-delivered modules (and sitting the appropriate exams on campus) each year. Specific modules 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. However, students are allowed to do the project earlier. 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 modules are delivered in block mode and that the block mode modules operate on a two-year cycle. Furthermore only Core A can be completed through block mode. Block mode modules available in the current academic year can be obtained from the ISG web site.

Assessment details and dates
The compulsory *Core* element (total of four modules) contributes 50% toward the final award of the MSc. The *Options* element (total of two modules, or optionally three modules) contributes 25% toward the final award of the MSc. The *Project* for the compulsory project element contributes 25% toward the final award of the MSc.

The modules that comprise the Core and Options elements are all assessed by two-hour written examination papers. For the Options element, students must sit at least two options exams. However students can choose to sit three options exams; in this case only the two highest marks will be used when determining the classification of the degree (but the degree transcript will still record information about all completed modules). 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 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).
Project Submission Date: 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.

Back to top

Award Requirements for the MSc
To decide whether or not a student will be awarded the MSc degree, and also to decide whether or not a distinction/merit will be awarded, the assessment results from each of the three programme elements (the core, options, and project elements) will be used.

To *pass* the MSc programme the student will normally need to achieve each of the following:

- an average of at least 50%, where the average is computed over the three elements, and where the core is given weight twice that given to the other two elements (i.e. so that the core element contributes 50% of the overall mark, and the other two elements 25% each);
- a minimum of 50% for the core element;
- minimum of 40% for the options and project elements, and a minimum of 50% for at least one of these two elements.

To be awarded a *merit* in the MSc programme the student will normally need to achieve each of the following:

- an average of at least 60%, where the average is computed over the three elements, and where the core is given weight twice that given to the other two elements (i.e. so that the core element contributes 50% of the overall mark, and the other two elements 25% each);
- a minimum of 50% in each of the three elements (i.e.in the core, options, and project elements).

To be awarded a *distinction* in the MSc programme the student will normally need to achieve each of the following:

- an average of at least 70%, where the average is computed over the three elements, and where the core is given weight twice that given to the other two elements (i.e. so that the core element contributes 50% of the overall mark, and the other two elements 25% each);
- a minimum of 50% in each of the three elements (i.e.in the core, options, and project elements).

Award Requirements for the PG Dip

To decide whether or not a student will be awarded the PG Dip, and also to decide whether or not a distinction/merit will be awarded, the assessment results from all three elements (core, options, and project) and also individual module results can be used.

To *pass* the PG Dip programme the student will normally need to obtain a minimum of 120 credits. There are four combinations in which these credits can be made up:

1. a minimum of 50% for the core and the options element (worth 80 and 40 credits respectively);
2. a minimum of 50% for the core and the project element (worth 80 and 60 credits respectively);
3. a minimum of 50% for the project and options element, and a minimum of 50% in one core module (worth 60, 40, and 20 credits respectively);
4. a minimum of 50% for the project element and a minimum of 50% in three modules of which at least one must be a core module (worth 60 and 3*20 credits respectively).

To be awarded a *merit* in the PG Dip programme the student will normally need to achieve each of the following:

- satisfy the *pass* requirements as described above (i.e. obtain a minimum of 120 credits in at least one of the four combinations);
- an average of at least 60%. When calculating the average, the core has weight four, options and project have a weight of two, and an individual module has weight one.

So if C, O, P, and M are the core, options, project, and individual module percentages, then the average for the four combinations are:

1. $(4C + 2O)/6$
2. $(4C + 2P)/6$
3. $(2P + 2O + M)/5$
4. $(2P + M1 + M2 + M3)/5$ where M1, M2, M3 are the three individual module percentages

To be awarded a *distinction* in the PG Dip programme the student will normally need to achieve each of the following:

- satisfy the *pass* requirements as described above (i.e. obtain a minimum of 120 credits in at least one of the four combinations);
- an average of at least 70%. When calculating the average, the core has weight four, options and project have a weight of two, and an individual module has weight one.

Award Requirements for the PG Cert

To decide whether or not a student will be awarded the PG Cert, the assessment results from the core element, options element, and also individual module results can be used.

To *pass* the PG Cert programme the student will normally need to obtain a minimum of 60 credits. There are three combinations in which these credits can be made up:

1. a minimum of 50% for the core element (worth 80 credits);
2. a minimum of 50% for the options element, and a minimum of 50% in one core module (worth 40 and 20 credits respectively);
3. a minimum of 50% in three modules of which at least one must be a core module (worth 3*20 credits).

Failing Students

A student who fails the MSc, PG Dip, or PG Cert at the first attempt is normally allowed **only one** further attempt to re-sit or re-take any element for which an element mark of less than 50% was obtained. Normally such attempts must be made at the next available opportunity. In the case of a failed core or options element, students will only be allowed to re-sit or re-take modules in which the un-weighted exam score was less than 50%. Additionally, any student that has failed the MSc, but has satisfied the criteria for the PG Dip or PG Cert award, will be awarded a PG Dip or PG Cert.

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
- All students are provided with detailed programme information, including a programme handbook, programme specification and individual module specifications
- Several modules include small-group tutorials. Additional tutorials are also available during the first term for any students needing to consolidate their background knowledge in particular areas such as computer networks and operating systems or basic maths for cryptography
- Personal Advisers. 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
- 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 modules which make up the programme have dedicated websites which include learning materials and booklists, and also the ISG's website discussion board
- Extensive supporting materials and learning resources are available in both the Bedford Library and Computer Centre
- Students enjoy access to the College Careers Services
- Students enjoy access to all College support services, including the Student Counselling Service, Health Centre, Education Support Unit for students with special needs, College Chaplaincy and the Student Union
- Students enjoy membership of a number of research centres and libraries in Central London, including the University of London's Senate House library
- The Student-Staff Committee acts as a two-way channel of communication between the Information Security Group and students on the MSc/PG Dip/PG Cert programme.

Admission requirements
Students are normally expected to have at least a Second Class Honours degree in a relevant discipline, or an equivalent qualification acceptable to the University of London. A relevant discipline includes, but is not restricted to, computer science, electronics, information systems and mathematics. Applications from mature students, who do not possess a degree but have appropriate industrial or commercial experience, are also welcomed. Students whose first language is not English may also be asked for a qualification in English Language at an appropriate level. For further details please refer to the Prospective Students web page. It may also be helpful to contact the Admissions Office for specific guidance on the entrance requirements for particular programmes. All 'non-standard' applications are viewed sympathetically, each case being considered individually on its merits.

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, 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.

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

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.

Royal Holloway's position as one of the UK's leading research-intensive institutions was confirmed by the results of the most recent Research Assessment Exercise (RAE 2008) conducted by the Higher Education Funding Council (HEFCE). The new scoring system for the RAE 2008 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. 60% of the College's research profile is rated as world-leading or internationally excellent outperforming the national average of 50%. The College is ranked 16th in the UK for research of 4* standard and 18th for 3* and 4* research.

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 leads to an award of Royal Holloway and Bedford New College. Programmes in Information Security are not subject to accreditation by a professional body. The Banner programme codes are given in parentheses.

Master of Science Programme in Information Security

> MSc in Information Security (1221)
> MSc in Information Security (CPD) (2348)

Postgraduate Diploma in Information Security

> PG Diploma in Information Security (2304)

Postgraduate Certificate in Information Security

> PG Certificate in Information Security (2681)