Faculty of
Computing, Engineering
and Mathematical Sciences

BSc (Hons) Computer Security

Definitive Documentation – January 2006

Part 1: Programme Specification

Part 2: Module Specifications

Part 3: Contextual Documentation

Contents **Page Number**

Part 1: Programme Specification

Programme Specification

Section 1: Basic Data

Awarding institution/body	University of the West of England
Teaching institution	University of the West of England
Faculty responsible for programme	Computing, Engineering and Mathematical Sciences
Programme accredited by	N/A
Highest award title	BSc (Hons) Computer Security
Default award title	
Interim award title	BSc Computer Security Diploma of HE, Computer Security Certificate of HE, Computer Security
Modular Scheme title (if different)	
UCAS code (or other coding system if relevant)	
Relevant QAA subject benchmarking group(s)	Computing (primary)
On-going/valid until* (*delete as appropriate/insert end date)	
Valid from (insert date if appropriate)	1st September 2006

Authorised by… **Date:…**

Version Code 1

For coding purposes, a numerical sequence (1, 2, 3 etc.) should be used for successive programme specifications where 2 replaces 1, and where there are no concurrent specifications. A sequential decimal numbering (1.1; 1.2, 2.1; 2.2 etc) should be used where there are different and concurrent programme specifications

Section 2: Educational Aims of the Programme

The general aims of the programme are:

1. To prepare students for careers in computer security
2. To develop problem-solving, communication and other transferable skills applicable to a variety of careers
3. To prepare students for study for higher degrees in related subjects
4. To continue the development of those general study skills that will enable students to become independent, lifelong learners.

The specific aims of the programme are

1. To develop knowledge of computer hardware and software systems
2. To provide a solid background in the theoretical and practical aspects of computer security.
3. To understand the key issues in preservation of information confidentiality, integrity, and availability.
4. To introduce the legal and commercial aspects of Information Security.

Section 3: Learning Outcomes of the Programme

The programme route provides opportunities for students to develop and demonstrate knowledge and understanding, intellectual skills, subject-specific skills and transferable skills, as shown below.

A. Knowledge and Understanding

Knowledge and Understanding of:	Teaching/Learning Methods and Strategies	Assessment
1. Software design, computer systems and networks	During the first year, students are introduced to concepts involved in constructing simple software, and the components of computer systems and networks. This knowledge is gradually extended during the second and third year to give a comprehensive understanding of software design and distributed and networked systems.	Assessment will be by a combination of examination and coursework. For many aspects of this programme the coursework will contain a significant practical element, for example in the modules Computer Networks and Security and in Secure Smart Cards and Tokens. Where appropriate, other forms of assessment such as observation of a presentation or viva may be used.
2. Information, data and its representation and organisation in computer systems	Beginning in the first year with data modelling techniques and continuing into the second year with schemas, students learn how information can be represented as data within a computer.	
3. Trusted computing base, threats and security policy. Computer security mechanisms in networks and computers at various layers and levels. 4. Legal and commercial aspects of Information Security	By the second year students have gained a better understanding of computer systems, algorithms and protocols and study Computer and Network Security and Cryptography. It is in these modules that they learn the fundamentals of computer security. The legal aspects of computer security are first touched on in Computer Crime and Digital Evidence in year one. Legal, commercial and other aspects of security are further explored in a practical context in the module Security Management in Practice where broader security issues of delivering end to end applications and services are studied.	

5. Security management. Defining, modelling and describing the concepts of trust and security policy. 6. Securing access to services and applications from set top boxes, access terminals and mobile devices. Security technology innovations.	With the convergence of mobile telecommunications, digital broadcasting, e-commerce and the internet, accessing services provides new security challenges. In Practical Security Management final year students study how security is implemented and managed in real world systems. Legal, commercial and other broader aspects of security are explored in delivering end to end applications and services. A more in depth study of the concepts of trust and policy are also covered in this module. Case studies will be made available and as part of the delivery of Practical Security Management a number of industry security experts will be invited to speak on their experiences of security management. The consequence of this convergence of technologies is the ability to access services and applications from different terminals and location points and whilst on the move. Secure Smart Cards and Tokens provides an understanding of how secure access to these services and applications can be achieved under these circumstances using security mechanisms and concepts studies in the second year. Smart card toolkits and security libraries will be available for the practical investigations.	

B. Intellectual Skills

Intellectual Skills	*Teaching/Learning Methods and Strategies*	*Assessment*
Students will develop intellectual skills in: 1. Critical Thinking 2. Analysis 3. Synthesis of different types of information 4. Evaluation 5. Problem Solving 6. Appreciate problem contexts 7. Balance conflicting objectives	Throughout this programme students are confronted with problem solving exercises in the context of computing in general and Computer Security in particular. In the process of devising solutions to these problems, the intellectual skills listed here are encouraged and developed. As they move through the programme, these skills are developed at increasing levels of sophistication through the use of scenarios that move from the simple and well-bounded to the complex and ill-structured. For example, in the first year students are introduced to computer security via the Computer Crime & Digital Evidence module where they gain an appreciation of the issues surrounding computer security. During this first year they will develop computer programs, design database applications, use design notations and design methodologies. In the second year these skills are further developed by designing and programming larger and more complex software systems. It is at this stage that the fundamental computer security mechanisms and concepts are introduced in modules Computer & Network Security and Cryptography. Security protocols and algorithms are analysed and the concept of a trusted computing base is developed. Understanding of abstract concepts is developed through practical exercises using software security libraries. These practical exercises in turn develop understanding of software engineering of dependable computing systems. In the final year Security Management module broadens the scope of security beyond the confines of computers and networks through the use of case studies of real industrial applications. In contrast Secure Smart Cards & Tokens specialises security knowledge and skills. Students will have access to smart card development toolkits and will be able to develop smart card applications. At all levels students are required to bring together knowledge and skills acquired in different subsidiary disciplines and hence determine new ways of approaching	The consideration of appropriate computer security strategies requires the demonstration of all of the intellectual skills listed here. At level 1 the focus in programming coursework assessment, undertaken in a number of modules, is on the skills of Analysis (2), Evaluation (4) and Problem Solving (5). At levels 2 and 3 this branches out to include all the remaining skills. Many of the coursework assessments and exam papers include elements of programming work. Independent reading is used to enable students to focus on their own areas of interest and in the process assess skills 1-4 in the submitted reports, essays and exam answers. Design-work, even when not implemented in a programming language, requires demonstration of skills 1,2,5,6,7 and a number of coursework assessments and exam questions are devoted to such work. Finally, all of the examinations assess skills 1-4 whilst skills 5-7 are covered in many exams.

	problems. As the student progresses, the need to synthesise (3) ever-greater volumes of information and requirements into a coherent approach is developed and consequently so is their critical thinking (1). At level 1 Analysis (2), Evaluation (4) and Problem Solving (5) are developed on small-scale problems in various computing-based activities in a number of modules. At this level the focus is on understanding the problem and then solving it in simplified environments, often without the need to examine alternatives and to balance conflicting goals. At level 2 there is a move away from small-scale problems with modules on computer networks, operating systems and systems design. For example security mechanisms exist at all layers and levels of networks and computers so with this comes the need to evaluate (4) appropriate integration approaches, understand the end to end context (6) and to balance conflicting objectives (7). Level 3 sees the move to complex situations where it will be necessary to build on all the intellectual skills acquired earlier in the programme. It culminates with the individual project.	

C. Subject, Professional and Practical Skills

Subject/Professional/Practical Skills	***Teaching/Learning Methods and Strategies***	***Assessment***
Students will be able to: 1. Demonstrate the fundamental skills expected of a graduate of a computing discipline, including programming, software design and the implementation of databases 2. Describe the key security mechanisms used in access control, authentication, encryption and digital signatures. 3. Use software libraries and toolkits to implement security aware applications 4. Perform systems analysis in terms of computer security. 5. Employ a range of tools and notations to support the activities listed above.	Throughout the programme, the skills listed are developed through a combination of theoretical discussion, practical laboratory based work, classroom based tutorial exercises and directed self-study. Some of the skills listed (1, 5) are introduced at level 1 and then drawn into sharper focus at levels 2 and 3. The general teaching/learning method is therefore to impart these practical/professional skills by a process of moving from an overview of what is required to a specific application of an individual skill at a higher level. Specific skills relating to Computer Security are introduced at level 2 after the foundation computer science knowledge has been gained. These fundamental security skills are extended and broadened in *Security Management in Practice* but extended and specialised in *Secure Smart Cards and Tokens.*	A combination of all or most of these skills will be required to successfully complete the final year project The practical nature of the skills to be acquired means that some are specifically addressed by particular modules (2,3,4). The more generic skills (1,5) are assessed across the programme. Assessment is in the form of the development of practical work, essays, presentations and exams. .

D. Transferable Skills and Other Attributes

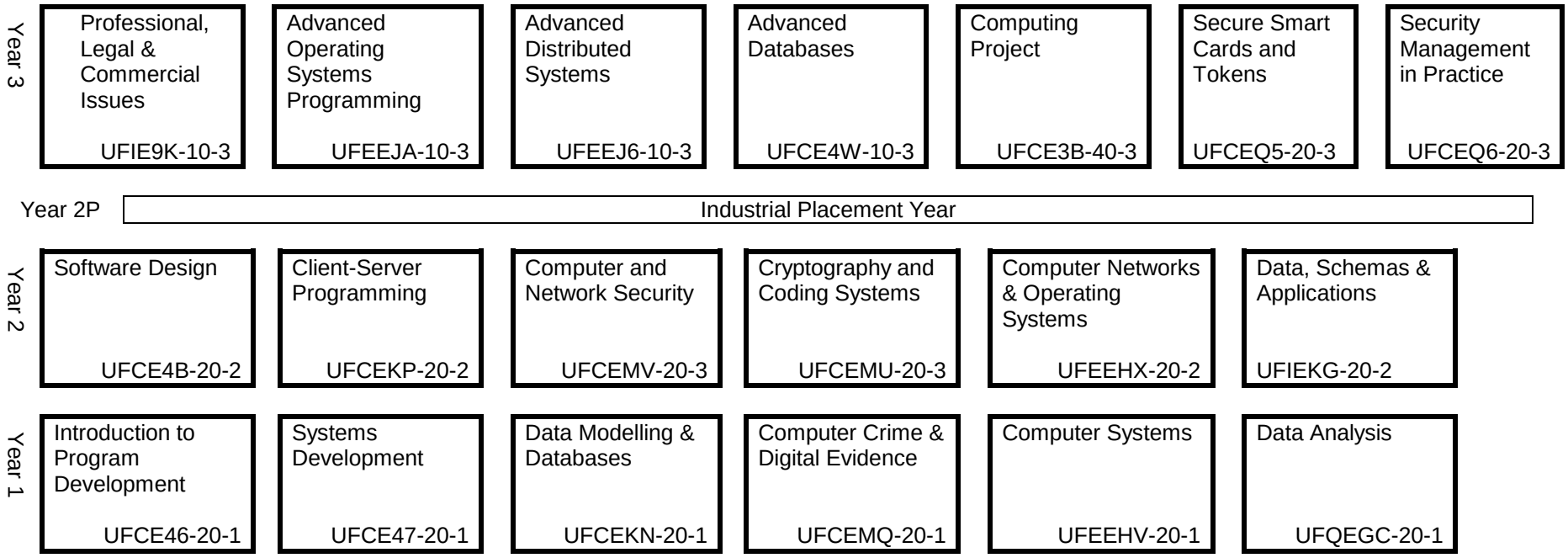
Transferable skills are developed throughout the programme by the means listed below. These skills are acquired at increasing levels of sophistication as the student moves through the programme. Thus at level 1 a student is required to engage in activities that are closed, highly structured and carefully directed; at level 2 tasks are less prescriptive and increasingly interdependent between students, groups and tutors; at level 3 the student is expected to undertake open tasks requiring skills in self-management and independent learning. The detail of this progression is given in the table below.

Transferable Skills and Other Attributes	***Teaching/Learning Methods and Strategies***	***Assessment***
1. Communication skills**:** to communicate orally or in writing, including, for instance, the results of technical investigations, to peers and/or to "problem owners".	1. Skill one is developed through a variety of methods and strategies including the following: • Students maintain laboratory log books • Students participate in electronic conferences, workshops, and groupwork sessions. • Students participate in discussion tutorials • Students present research topic findings in tutorials • Students participate in individual tutorials	These skills are demonstrated in a variety of contexts including • Examination • Individual and group projects • Practical assignments • Portfolio of exercises
2. Self-management skills: to manage one's own time; to meet deadlines; to work with others having gained insights into the problems of team-based systems development.	2. Skill two is developed through a variety of methods and strategies including the following: • Students conduct self-managed practical work • Students participate in practically-oriented tutorial laboratory sessions • Students work through practical work-sheets in teams • Students practice design and programming	
3. IT Skills in Context (to use software in the context of problem-solving investigations, and to interpret findings)	3. Skill three is developed widely throughout the programme.	
4. Problem formulation: To express problems in appropriate notations.	4. Skill four is developed through a variety of methods and strategies including the following: • Students practice design and programming • Students devise security procedures in the design of an application.	

5. Progression to independent learning: To gain experience of, and to develop skills in, learning independently of structured class work. For example, to develop the ability to use on-line facilities to further self-study.	5. Skill five is developed through a variety of methods and strategies including the following: • Students practice programming to extend their skills • Students research relevant computing and security topics • Students use online facilities to extend their knowledge	
6. Comprehension of professional literature: to read and to use literature sources appropriate to the discipline to support learning activities.	6. Skill six is developed through a variety of methods and strategies including the following: • Students are encouraged to maintain their awareness of computing and security issues via both printed and online materials	
7. Working with Others**:** to be able to work as a member of a team; to be aware of the benefits and problems which teamwork can bring.	7. Skill seven is developed through a variety of methods and strategies including the following: • Students carry out work in small, self-managed groups	

Section 4: Programme Structure

For **BSc (Hons) Computer Security** **For January 2006**



PLEASE NOTE: REFER TO THE FACULTY ON-LINE INFORMATION SYSTEM FOR UP-TO-DATE STRUCTURE INFORMATION

http://www.cems.uwe.ac.uk/exist/index.xql

Section 5: Entry Requirements

The university's minimum requirements for entry to a degree apply to this programme. In addition entrants are required to have evidence of achievement in Mathematics at GCSE Grade C or equivalent.

Section 6: Assessment Regulations

The Modular Assessment Regulations apply to this programme

Section 7: Student Learning: Distinctive Features and Support

Class Activities The mode of delivery of a module is determined by its Module Leader, and typically involves a combination of one or more lectures, tutorials, 'lectorials', laboratory classes, group activities and individual project work. Modules are often delivered by means of 'lectorials', classes for groups of 20-30 students with no distinction between lectures and tutorials, and this has proved to be an effective mechanism for modules at Level 1.
Where modules are common with other programmes, students will typically be taught together (which gives students the opportunity to appreciate the material from the viewpoint of different disciplines).
The distinctive feature of this award is the emphasis placed on the design and development of secure and dependable software and systems. Students will be able to gain practical experience of developing secure applications by using standard security software libraries which are accessible from most machines within the Faculty. Smart card, SIM and RFID toolkits will also be available for students to investigate and develop secure systems.

Academic Support Academic advice and support is the responsibility of the staff delivering the module in question. Staff are expected to be available outside normal timetabled hours, either by appointment or during published "surgery" hours, in order to offer advice and guidance on matters relating to the material being taught and on its assessment..

Pastoral Care The faculty's offers pastoral care through its Student Advisers, a team of staff who provide comprehensive, full-time student support service on a drop-in basis or by appointment. All students on the same route are allocated to the same Adviser, who is trained to provide advice on matters commonly of concern, including regulatory and other matters; the Adviser will, when necessary, advise the student to seek advice to from other professional services including the university's Centre for Student Affairs or from members of academic staff.

Progression to Independent Study
Many modules require students to carry out independent study, such as research for projects and assignments, and a full range of facilities are available at all sites to help students with these. The philosophy is accordingly to offer students both guided support and opportunities for independent study. Guided support, mainly in the form of timetabled sessions, takes the form of lectures, tutorials, seminars and practical laboratory sessions. Students are expected to attend all sessions on their timetable, and this is especially important because of the high content of practical work in the programme.

The progression to independent study will also be assisted by the nature of the support offered in individual modules. Typically, module leaders will provide a plan for the module indicating the activities to be carried out and the forms of learning to be undertaken during the delivery of the module, with a view to encouraging students to plan ahead and to take responsibility for managing their time and resources.

Computing Facilities The Faculty offers specialised computing facilities and user support alongside the general University provisions. Their nature and extent changes from time to time, as hardware and software provision is updated to follow technological change and as availability of resources permits. This section describes current provision.

There are nine general PC computing laboratories of 20 plus seats all running Windows2000, along with four Unix based laboratory and 10 specialist computing labs. The specialist laboratories are equipped with the specific software for CEMS students; including Software Design Tools development environment, CAD, finite element analysis, mathematics and statistics packages to support the taught program. The specialist Computing laboratories are designed to target the discipline taught in that area. Amongst these, is the Computer Systems Architecture and Linux laboratory. The Unix labs offer the latest web development and programming tools.

The Faculty also provides an Open Access laboratory for student use. This area is never time-tabled and gives students the opportunity to access machines at all times during opening hours. This is a mixed environment consisting of PCs and Unix workstations.

The Faculty's user support Helpdesk provides fist line support to the user base, uniquely supported by both permanent staff and students that are in their second or final year of study (employed on a part time basis) until 20.00hrs every day. These general purpose and specialist laboratories are available to students up until midnight, seven days per week.

Careers Support The faculty works with the Career Development Unit to ensure that students develop their employability to a level that will enable them to compete effectively for jobs in the graduate labour market. Careers support can take a range of forms including timetabled workshops and individual guidance, and can supplement the nurturing of key transferable skills through teaching and learning within the curriculum.

Placement Opportunity This programme allows students to spend their third year with a placement organisation before returning to university to complete their final year of study. The placement year is a period of paid employment which offers an excellent opportunity to apply the concepts learned during the first two years in a commercial/industrial context. Whilst we cannot guarantee that a suitable placement will be found, the faculty has a placements office to provide the students with a reliable and knowledgeable contact point for any issues or queries. The placement office keeps a list of companies who have taken placement students in the past and can provide help with writing job applications. Comprehensive preparatory material and continuing support is also made available through this office. The module specification lists some of this support in more detail. A senior academic is attached as placements co-ordinator to provide leadership and support.

Whilst on placement, each student is assigned a placements tutor from the university as well as an industrial supervisor. Each student is visited at their workplace with their industrial supervisor to ensure that the activities within the placement are suitable to meet the required learning outcomes. Placements are often a rich source of topics to be pursued in a final year project and/or permanent job offers on graduation.

Section 8 Reference Points/Benchmarks

In designing this programme, the faculty has drawn upon the following external reference points:

1. The QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland
2. The QAA Benchmark Statement for Computing
3. UWE's Learning & Teaching Strategy

The QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland describes the attributes and skills expected of Honours graduates. It is our view that the learning outcomes of this programme are fully consistent with the qualification descriptor in the Framework, and hence that graduates will be able to demonstrate that they meet the expectations of the Framework.

UWE's Learning & Teaching Strategy has informed the faculty's policy for the delivery of its programmes, whose main features are described in Part 3, section 5

The QAA Subject Benchmark Statement for Computing was published in 2000, and is applicable to this proposal.

The benchmark statement describes Security and Privacy as a key knowledge area within the domain of computing. It lists this body of knowledge as:

Security and privacy: the problems. Illustrations of how problems arise. Physical and logical security. Machine access. Protection mechanisms. Encryption and encryption building blocks. Virtual private networks. Legal issues. Firewalls and internet security. Monitoring of traffic and computer use. Digital signatures. e-commerce, e-banking and related applications.

In terms of the benchmark's high-level characterisation of Computing, the emphasis of this programme is on *software*, *communication, theory and interaction* & *practice*. In addition to the security body of knowledge elements of the following are considered essential to a study of Computer Security:

Software Engineering
Systems Analysis and Design
Theoretical Computing
Web-based Computing
Programming Languages
Computer Based Systems
Computer Networks
Databases
Data Structures and Algorithms
Distributed Computer Systems
e-commerce
Human-Computer Interaction (HCI)
Operating Systems
Programming Fundamentals
Professionalism

The Computing Benchmark Statement also contains (section 5) statements of the standards expected of graduates at both modal and threshold levels. The team is of the view that graduates of the proposed programme will be able to meet the required standards.