UNIVERSITY of BRADFORD

Faculty of Engineering and Informatics

BSc (Hons) Computer Science for Cyber Security Programme Specification

Academic Year: 2022-23

Degree Awarding Body: The University of Bradford

Final and interim awards:

Honours Degree of Bachelor of Science [Framework for Higher Education Qualifications (FHEQ) level 6]

Ordinary Degree of Bachelor of Science [FHEQ level 6]

Diploma of Higher Education [FHEQ level 5]

Certificate of Higher Education [FHEQ level 4]

Programme Admissions: September

Programme duration: 3 years full-time; 4 years full-time including placement or study abroad

Programme Accreditation: BCS - The Chartered Institute for IT

QAA Subject Benchmark Statement: Computing (2019)

UCAS code: I190 (3 year route), I191 (4 year route)

Date approved by Senate: December 2021

Please note: This programme specification has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but changes may occur given the interval between publishing and commencement of teaching. Any change which impacts the terms and conditions of an applicant's offer will be communicated to them. Upon commencement of the programme, students will receive further detail about their course and any minor changes will be discussed and/or communicated at this point.

Minor Modification Schedule

1. November 2015: Updates from periodic review of programme completed.
2. May 2016: Updates from academic portfolio review completed.
3. November 2016: Minor corrections.
4. March 2019: Curriculum structure updated.
5. July 2021: Learning outcomes updated.
6. August 2021: Final updates for 2021/2 academic year completed.
7. December 2021: Reaccredited by BCS.
8. April 2022: Specification reformatted, updated professional services texts and programme updates for the 2022/3 academic year.

Introduction

This Computer Science programme has a specific focus on the theoretical foundations of computation and computer technology and how Computer Science is applied to Cyber Security. It incorporates ideas from many other disciplines, including mathematics, engineering and management, and has a close affinity with digital communications as illustrated by the Internet, World Wide Web, and wireless communication technologies.

The **BSc Computer Science for Cyber Security** is offered by the Department of Computer Science, part of the Faculty of Engineering and Informatics in the University of Bradford, which includes a renowned tradition of undergraduate and postgraduate programmes concerned with the understanding, design, and exploitation of computation and computer technology. The Department places great emphasis on both teaching and research, and there are opportunities for students to join one of our research teams, and progress on to postgraduate taught programmes or research degrees on completion of their first degree. Note that the British Computer Society (BCS) for computing professionals accredits undergraduate and postgraduate programmes offered by the Department. Its accreditation of our programmes also means that successful honours graduates are exempted from further examinations for BCS membership.

Exposure to Industry is embedded within our programmes in a number of ways. Our Industry Advisory Board (IAB), with a membership comprised of industry representatives from both regional and national companies, meets twice a year to review our existing provision and to propose improvements throughout the academic year industry speakers and researchers deliver invited talks that inform and inspire our students about current and future developments within their discipline.

Student societies with links to professional bodies afford further opportunities for our students to engage with industry, such as Pi Soc as the first ever BCS Student Chapter, and our ACM student chapter. These societies are encouraged and supported by the Department to participate in industry and research led activities such as programming competitions, data dives and extra-curricular collaborations and visits. In addition, our placement scheme gives students the opportunity to work in real companies for up to one year as part of their programme, further enhancing their discipline specific and transferable skills.

Our teaching is informed by industry in several ways. Staff undertaking Knowledge Transfer Partnership projects, national and EU funded research projects and consultancy work embed new knowledge and concepts into their teaching materials and curriculum planning based on the research and development work they conduct.

The launch of the Computing Enterprise Centre offers our students the opportunity to develop industry-based projects and provides industry-sponsored competitive internships. We support industry placements and collaborate with local, national and international organisations offering students opportunities through our industry contacts and extended network of successful graduates.

Through our Computing Enterprise Centre we leverage industry contacts to embed cutting edge projects within modules such as Technical and Professional Skills in year 1, Enterprise-Pro in year 2 and Final Year Project in year 3, allowing students to work on topics highly relevant to their future careers throughout their course. Our Final Year Project showcase allows students to interact with both our Industry Advisory Board members and a wider audience of industry contacts to demonstrate their work and to receive feedback and ideas from professionals within the discipline.

Programme Aims

The aim of the programme is to provide students with a sound grounding in the fundamentals of computer science, Cyber Security, software development (programming) and the tools and applications that modern computer scientists use. This aim will be achieved by:

- Providing students with a core of fundamental modules, in stages 1 and 2, that are essential to all computer scientists, plus a range of options they will then specialise in Cyber Security.
- Providing the support in the form of lectures, labs and tutorials that will enable students to develop their personal portfolio of skills and knowledge, in line with the Department of Computer Science's commitment to providing a very high standard of academic delivery and environment, supported by up-to-date computing facilities, hardware devices and software tools.
- Developing discipline and personal transferable skills as business innovators so that during studies and on graduation they may move directly into responsible positions in industry or commerce (such as placement or graduate schemes respectively) or may pursue further programmes of study.
- Enabling development of problem analysis and computational solutions by application of fundamental principles and concepts of computer science, such as abstraction, data representation, logic, algorithms, and digital technologies.
- Promoting educational opportunities and interest in academic development for ethnic minorities, women, mature and alternatively qualified students, as well as for school-leavers and traditionally qualified students.

Programme Learning Outcomes

To be eligible for the FHEQ Level 4 award of Certificate of Higher Education, students will be able to:

1. Describe the history and development of computer science and outline important concepts and topics within the field.
2. Outline the professional, ethical, security, industrial and research dimensions of the discipline of computer science.
3. Demonstrate knowledge of fundamental concepts of computer science, and the environment in which they operate; basics of software construction and the tools required to support it, develop skill in constructing complex software solutions.
4. State and explain relevant models, principles and practices applicable to the study of computers, computer architecture and systems.
5. Demonstrate knowledge of a range of underlying theories, logical and mathematical foundations relevant to computer science.
6. Work effectively as individuals and in groups.

7. Collect, manage and present information, ideas and concepts, interpret data using suitable techniques, and communicate efficiently with a range of audiences.

Additionally, to be eligible for the FHEQ Level 5 award of Diploma of Higher Education, students will be able to:

8. Apply methods, methodology, knowledge, skills and standards to build and test complex software systems through teamwork.
9. Apply knowledge of investigative and research principles to demonstrate an understanding of how to develop computing designs, databases, and processes.
10. Develop computational thinking for problem solving, algorithm design and assessing efficiency of different implementations.
11. Demonstrate the use of practical computer science skills in designing, developing and monitoring communication networks.
12. Demonstrate fundamental understanding of various applications of AI techniques in solving computational problems.
13. Apply knowledge of the fundamentals of security management and the system tools required to manage vulnerabilities.
14. Communicate effectively with industry and other computing professionals and demonstrate personal and technical skills.

Additionally, to be eligible for the award of Degree of Bachelor at FHEQ level 6, students will be able to:

15. Demonstrate a systematic understanding of key aspects of their field of study, including acquisition of coherent and detailed knowledge informed by aspects of Computer Science for Cyber Security.
16. Deploy accurately established techniques of analysis and enquiry within Computer Science for Cyber Security.
17. Show conceptual understanding that enables students to devise and sustain arguments, and/or to solve problems, using ideas and techniques, and to describe and comment upon particular aspects of current research, or equivalent scholarship, or practice in Computer Science for Cyber Security.
18. Develop an ability to make critical use of relevant literature to discuss aspects of current research in the discipline, to make use of primary sources, to manage and communicate their own learning, and to recognise the uncertainty, ambiguity and limits of knowledge.
19. Develop a systematic understanding of the fundamental concepts and theories of computer science including detailed knowledge of hardware, computer architecture, information, and communication technologies.
20. Understand how to analyse problems and develop solutions using leading edge ideas and techniques.

21. Exercise initiative in information management, interpretation and presentation of Cyber Security tools, products and solutions.
22. Understand and appreciate the nature of cybercrime and how to protect against it at a management level.
23. Demonstrate an understanding of the use of appropriate cryptographic primitives and protocols for securing network applications.
24. Apply and analyse issues of security from a number of different disciplinary perspectives.
25. Apply the concepts and principles in key computing subjects, including data and information security and forensics, information systems, communication networks.
26. Demonstrate professional interest and expertise for a variety of careers such as cyber security specialist, software security architect, software developer, system administrator, IT project manager, IT consultant or computing researcher that match both learners and employers' expectations.

Curriculum

The three academic Stages ask students to complete 120 credits per stage, corresponding to a FHEQ Level of study. Each 20-credit module on the programme requires students to commit 200 study hours. Many of these hours will be formally timetabled - lectures, laboratories, seminars and tutorials – and others will involve students carrying out private study or group work. The balance between these forms of study changes as they pass through the three years of the programme. There are many contact hours (time spent with academic tutors) in all stages of the programme; in the final year students will also be expected to manage their plan for the individual project, under the general guidance of their academic tutors. Please see Module Descriptors for a full reckoning of expected contact hours.

Stage 1(Level 4) Modules

Study Period	Code	Title	Type	Credits	FHEQ Level
Semester 1	COS4016-B	Fundamentals of Programming	Core	20	4
Semester 1	COS4014-B	Mathematics for Computing	Core	20	4
Semester 1	COS4015-B	Technical and Professional Skills	Core	20	4
Semester 2	COS4001-B	Computer Architecture and Systems Software	Core	20	4
Semester 2	COS4018-B	Internet Technologies	Core	20	4
Semester 2	COS4017-B	Software Design and Development	Core	20	4

At the end of stage 1 (level 4), students will be eligible to exit with the award of Certificate of Higher Education if they have successfully completed at least 120 credits and achieved

the award learning outcomes. THE EXIT AWARD OF CERTIFICATE DOES NOT CONFER ELIGIBILITY TO REGISTER WITH BCS.

Stage 2 (Level 5) Modules

Study Period	Code	Title	Type	Credits	FHEQ Level
Semester 1	COS5028-B	Artificial Intelligence	Core	20	5
Semester 1	COS5021-B	Data Structures and Algorithms	Core	20	5
Semester 1	COS5020-B	Database Systems	Core	20	5
Semester 2	COS5025-B	Computer Communications and Networks	Core	20	5
Semester 2	COS5019-B	Enterprise-Pro	Core	20	5
Semester 2	COS5017-B	System Security Management	Core	20	5

At the end of stage 2 (level 5), students will be eligible to exit with the award of Diploma of Higher Education if they have successfully completed at least 240 credits and achieved the award learning outcomes. THE EXIT AWARD OF DIPLOMA DOES NOT CONFER ELIGIBILITY TO REGISTER WITH BCS.

Stage 3 (Level 6) Modules

Study Period	Code	Title	Type	Credits	FHEQ Level
Academic Year	COS6006-D	Final Year Project	Core	40	6
Semester 1	COS6008-B	Cyber Security	Core	20	6
Semester 1	COS6009-B	Large Scale Data Driven Applications	Option	20	6
Semester 1	COS7025-B	Mobile Application Development	Option	20	7
Semester 2	COS6007-B	Foundations of Cryptography	Core	20	6
Semester 2	COS6025-B	Principles of Security Technologies	Core	20	6

Students will be eligible to exit with the award of Ordinary Degree of Bachelor if they have successfully completed 240 credits at level 4/5 and 60 credits at level 6/7. THE EXIT AWARD OF ORDINARY DEGREE DOES NOT CONFER ELIGIBILITY TO REGISTER WITH BCS.

At the end of stage 3 (level 6), students will be eligible for the award of Honours Degree of Bachelor if they have successfully completed at least 360 credits and achieved the award learning outcomes. ONLY THIS AWARD CONFERS ELIGIBILITY TO REGISTER WITH BCS.

Please note: the curriculum may change, subject to the University's approval, monitoring and review processes.

Placement and/or Study Abroad

This programme provides the option for students to undertake a work placement or period of study abroad between Stages 2 and 3. Students wishing to take this option will be registered for the 4-year programme.

Students can alternatively go abroad for one or two semesters during their second year. Students will undertake modules to replace those they would have studied at the University of Bradford.

On successful completion of the ENG5002-Z placement module, students will be eligible for the additional award of University Diploma Industrial Studies.

On successful completion of the ENG5004-Z study abroad experience module, students will be eligible for the additional award of University Diploma Industrial Studies (International).

For further information about study abroad opportunities please refer to: https://www.bradford.ac.uk/study/abroad/

Learning, Teaching and Assessment Strategy

Students will experience a wide range of teaching and learning environments and a consistent balance between direct academic delivery, and individual and group study. Concepts, principles and theories are generally explored in formal lectures, practiced in associated tutorials and seminars, and demonstrated and experimented in laboratory classes. Practical skills are developed in laboratory sessions. The programme includes a number of innovative and active learning methods. For example, Team Based Learning (TBL) strategies are integrated within a number of modules. In addition, we endeavour to use team teaching methods where lecturing staff are able to contribute their highly specialised research and knowledge into the curriculum.

Throughout the programme, we make use of case studies so that students can apply their theoretical understanding to real-world issues. In this way, abstract concepts are brought to life through practical activities.

In addition to the standard technology enhanced learning approaches, we embed technologies to deliver key concepts in an interactive environment that strongly links theory with practical skills. For example: in programming lectures, a remote desktop application allows lecturers to demonstrate coding in an environment identical to that in our cutting-edge labs; our stage 2 Enterprise-Pro module requires and supports students to develop their projects using an industry standard tool for collaborative team-based software development. This allows them to develop industry standard skills based on real working practice.

Professional and personal skills are developed through the Technical and Professional Skills module which involves communications skills, library skills, group work and presentations. The Enterprise-Pro group project module develops an appreciation of how to manage group dynamics whilst working on a substantial computing and software engineering exercise. Honours students undertake a major individual project in their final year, drawing together the knowledge and experience gained throughout the programme.

The project provides the opportunity for students to demonstrate the ability to solve problems using current ideas and current, cutting-edge techniques that are at the forefront of computing and applied multidisciplinary disciplines.

All of our staff have achieved, or are working towards, Fellowship of the Higher Education Academy. As part of our commitment to Excellence in Learning and Teaching, we conduct research into innovative and effective teaching methods. For example, assessment for our Final Year Project module was enhanced by incorporating regular formative and summative feedback opportunities to enhance the final outcomes, based on a research project conducted by staff within the Department that culminated in a journal publication.

Research active staff are involved in curriculum development based on their research activities, exposing students to the very latest and future developments within their field of expertise. We integrate knowledge and experience from Industrial partners through both our Industry Advisory Board and research projects through case studies, lab-based activities and invited talks, ensuring that research findings are at the heart of our curriculum.

Assessment Strategy

Methods of assessment are varied, and progress will be assessed using a mix of formal examinations, presentations and seminar papers, reports, laboratory tests, essays, coursework assignments, and projects. The appropriate method is chosen so that students may demonstrate the particular learning outcomes of each module.

Assessment Regulations

This Programme conforms to the standard University Undergraduate Assessment Regulations which are available online at: https://www.bradford.ac.uk/regulations/

Admission Requirements

We take into consideration a number of factors when assessing your application. It's not just about your grades; we take the time to understand your personal circumstances and make decisions based on your potential to thrive at university and beyond.

There are no subject-specific requirements for admission to this programme. A typical offer for students applying through the UCAS scheme would be **112 tariff points**.

All applicants need GCSE Mathematics grade C/4 and GCSE English grade C/4 or equivalent. Other RQF Level 2 qualifications such as Key Skills are acceptable. Students whose first language is not English should check the standard University language requirements at https://www.bradford.ac.uk/international/entry-requirements/.

Please note: This information is relevant to the contemporary recruitment cycle and therefore may be different now to when this document was originally published. The current UCAS tariff for the programme, as well as accepted equivalent qualifications, is published online at the course page: https://www.bradford.ac.uk/courses/ug/computer-science-for-cyber-security-bsc/

Access and Recognition of Prior Learning

Applications are welcome from students with non-traditional qualifications, and/or significant personal/professional experience. For such applicants, evidence of their interests and work experience would be required and this would likely take the form of a portfolio of work and/or an interview with the programme.

The University of Bradford has always welcomed applications from disabled students. To discuss adjustments or to find out more about support and access, you may wish to contact Disability Services before you apply online: www.bradford.ac.uk/disability/before

Applications are particularly welcomed from adult learners (those aged 21+ at the start of the programme), armed forces families, carers and care leavers, estranged or orphaned learners, refugees and asylum seekers, and Romani or Traveller families. To find out more about the University of Bradford Progression Scheme, visit the webpage: https://www.bradford.ac.uk/applicants/progression-scheme/

If applicants have prior certificated learning or professional experience which may be equivalent to parts of this programme, the University has procedures to evaluate and recognise this learning in order to provide applicants with exemptions from specified modules or parts of the programme. For more details on RPL, visit the webpage: https://www.bradford.ac.uk/teaching-quality/prior-learning/