UNIVERSITY of BRADFORD

Faculty of Engineering and Digital Technologies

# BSc Computer Science for Cyber Security (with Integrated Foundation Year) Programme Specification

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| Academic Year: | 2024/25 |
| Degree Awarding Body: | University of Bradford |
| Final and interim award(s)<br><br>Framework for Higher Education Qualifications (FHEQ) | BSc (Honours) [FHEQ level 6]<br><br>BSc (Ordinary) – exit award [FHEQ level 6]<br><br>Diploma of Higher Education (DipHE) [FHEQ level 5]<br><br>Certificate of Higher Education (CertHE) [FHEQ level 4]<br><br>Certificate of Engineering Foundation Studies<br><br>[Regulated Qualifications Framework (RQF) Level 3] |
| Programme accredited by (if appropriate): | BCS |
| Programme duration: | 4 years full time<br><br>5 years full-time including a year of study abroad and/or work placement |
| UCAS code | i192: BSc 4 years with integrated FY<br><br>i193: BSc 5 years with integrated FY and placement year |
| QAA Subject benchmark statement(s): | Computing |
| Date last confirmed and/or minor modification approved by Faculty Board | July 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.

## Introduction

Computers play such a fundamental part of our everyday life that is difficult to imagine what we would do without them. A lot of the information processed by computers is private and it is crucial that it is protected. Cyber Security is necessary to prevent unauthorised access to the information that we store on our devices (computers, smartphones, tablets, etc.) and online, and defend ourselves against an ever-evolving host of cyber attacks to, for example, online banking, social networks, businesses and critical infrastructure.

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 (Hons) Computer Science for Cyber Security is offered by the School of Computer Science, AI and Electronics as part of the Faculty of Engineering and Digital Technologies at 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 School 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 School. Its accreditation of our programmes also means that successful honours graduates are exempted from further examinations for BCS membership. Our students are also eligible for free student membership of the Chartered Institute of Information Security (CIISec), thanks to our partnership with CIISec.

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 School 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.

Upon completing this programme, students will not only become experts on existing Cyber Security solutions, but they will also be able to develop new ones. This programme will give students the toolkit required to flexibly adjust as new cyber threats emerge.

## 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 scientist's 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 School of Computer Science, AI and Electronics' 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 so that during studies and on graduation they may move directly into responsible positions in industry or commerce (such as placement, graduate schemes respectively) and as business innovators, 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 award of Certificate of Foundation Studies at QCF/NQF Level 3, students will be able to:

PLO 0.1 Apply knowledge and understanding of mathematics, mechanics, physics, materials and chemistry to an appropriate standard to allow students to engage with an accredited Computer Science programme.

PLO 0.2 Demonstrate knowledge and skills in the use of computers for word processing, report writing, data processing, power-point presentation, Computer Aided Design; numerical methods for simple modelling and analysing engineering problems relevant to their chosen specialism; selection and application of principles and data collection & manipulation methods to support problem solving; undertake and report on an investigation.

PLO 0.3 Demonstrate knowledge and skills in data management and presentation, IT and communication skills, systematic problem solving, lifelong learning, scientific method, teamwork, and personal management.

Additionally, to be eligible for the award of Certificate of Higher Education at FHEQ level 4, students will be able to:

PLO 1 Describe the history and development of computer science and outline important concepts and topics within the field.

PLO 2 Outline the professional, ethical, security, industrial and research dimensions of the discipline of computer science.

PLO 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.

PLO 4 State and explain relevant models, principles and practices applicable to the study of computers, computer architecture and systems.

PLO 5 Demonstrate knowledge of a range of underlying theories, logical and mathematical foundations relevant to computer science.

PLO 6 Work effectively as individuals and in groups.

PLO 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 award of Diploma of Higher Education at FHEQ level 5, students will be able to:

PLO 8 Apply methods, methodology, knowledge, skills and standards to build and test complex software systems through teamwork.

PLO 9 Apply knowledge of investigative and research principles to demonstrate an understanding of how to develop computing designs, databases, and processes.

PLO 10 Develop computational thinking for problem solving, algorithm design and assessing efficiency of different implementations.

PLO 11 Demonstrate the use of practical computer science skills in designing, developing and monitoring communication networks.

PLO 12 Demonstrate fundamental understanding of various applications of AI techniques in solving computational problems.

PLO 13 Apply knowledge of the fundamentals of security management and the system tools required to manage vulnerabilities.

PLO 14 Communicate effectively with industry and other computing professionals and demonstrate personal and technical skills.

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

PLO 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.

PLO 16 Deploy accurately established techniques of analysis and enquiry within Computer Science for Cyber Security.

PLO 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.

PLO 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.

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

PLO 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.

PLO 20 Understand how to analyse problems and develop solutions using leading edge ideas and techniques.

PLO 21 Exercise initiative in information management, interpretation and presentation of Cyber Security tools, products and solutions.

PLO 22 Understand and appreciate the nature of cybercrime and how to protect against it at a management level.

PLO 23 Demonstrate an understanding of the use of appropriate cryptographic primitives and protocols for securing network applications.

PLO 24 Apply and analyse issues of security from a number of different disciplinary perspectives.

PLO 25 Apply the concepts and principles in key computing subjects, including data and information security and forensics, information systems, communication networks.

PLO 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

### Stage 0 [Level 3]

| Module Code | Module Title | Type | Credits | Level | Study Period |
|---|---|---|---|---|---|
| ENM3001-B | Foundation Mathematics 1 | C | 20 | 3 | 1 |
| ENM3002-B | Foundation Mathematics 2 | C | 20 | 3 | 2 |
| MAE3001-B | Foundation Mechanics | C | 20 | 3 | 1, 2 |
| MAE3002-B | Foundation Physics | C | 20 | 3 | 1, 2 |
| MAE3003-B | Fundamentals of Materials | C | 20 | 3 | 1, 2 |
| ENB3001-B | Information and Communication Technology | C | 20 | 3 | 1, 2 |

At the end of Stage 0 (level 3) students will be eligible to exit with the award of Certificate of Foundation Studies if they have successfully completed 120 Level 3 QCF/NQF credits and achieved the specified learning outcomes.

### Stage 1(Level 4)

| FHEQ Level | Module Title | Type (Core/ Option/ Elective) | Credits | Semester (s) | Module Code |
|---|---|---|---|---|---|
| 4 | Mathematics for Computing | C | 20 | 1 | COS4014-B |
| 4 | Technical and Professional Skills | C | 20 | 1 | COS4015-B |
| 4 | Fundamentals of Programming | C | 20 | 1 | COS4016-B |
| 4 | Computer Architecture and Systems Software | C | 20 | 2 | COS4001-B |
| 4 | Software Design and Development | C | 20 | 2 | COS4017-B |
| 4 | Internet Technologies | C | 20 | 2 | COS4018-B |

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.

THIS AWARD DOES NOT CONFER ELIGIBILITY TO REGISTER WITH BCS

## Stage 2 (Level 5)

| FHEQ Level | Module Title | Core/ Option/ Elective | Credits | Semester (s) | Module Code |
|---|---|---|---|---|---|
| 5 | Database Systems | C | 20 | 1 | COS5020-B |
| 5 | Data Structures and Algorithms | C | 20 | 1 | COS5021-B |
| 5 | Artificial Intelligence | C | 20 | 1 | COS5028-B |
| 5 | Enterprise-Pro | C | 20 | 2 | COS5019-B |
| 5 | Computer Communications and Networks | C | 20 | 2 | COS5025-B |
| 5 | System Security Management | C | 20 | 2 | COS5017-B |

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.

THIS AWARD DOES NOT CONFER ELIGIBILITY TO REGISTER WITH BCS

## Stage 3 (Level 6)

| FHEQ Level | Module Title | Core/ Option/ Elective | Credits | Semester (s) | Module Code |
|---|---|---|---|---|---|
| 6 | Final Year Project | C | 20+20 | 1,2 | COS6006-D |
| 6 | Cyber Security | C | 20 | 1 | COS6008-B |
| 7 | Mobile Application Development | C | 20 | 1 | COS7025-B |
| 6 | Foundations of Cryptography | C | 20 | 2 | COS6007-B |
| 6 | Principles of Security Technologies | C | 20 | 2 | COS6025-B |

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.

The curriculum may change, subject to the University's programme approval, monitoring and review procedures.

## 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 or 5-year programme.

On successful completion of the ENG5002-Z, placement, students will be eligible for the award of University Diploma Industrial Studies. On successful completion of the ENG5004-Z, study abroad experience, students will be eligible for the award of University Diploma Industrial Studies (International).

For further information about study abroad opportunities please refer to

https://www.bradford.ac.uk/study/abroad/

Overseas students studying on a Tier 4 Study Visa should be aware that the "Placement and/or Study Abroad" option will take the full programme study duration to 5 years, which is the maximum allowed on the visa, therefore requiring successful completion of each Stage of study at the first attempt.

## Learning and Teaching Strategy

Our Learning and Teaching Strategy is to provide a nurturing and supportive environment that enables students to become independent learners and problem solvers. For example, students receive formative feedback during lab sessions in order to identify areas for improvement. A personal academic tutor is assigned to each student to provide both academic and pastoral support. Peer assisted learning supports the student experience by utilising and enabling peer interaction and support.

At stage 0 (Foundation level), cognitive and personal skills are developed in more open-ended problem solving and design exercises, often tackled by working in small groups supported by members of academic, technical, and library staff. Project work is used to bring various aspects of the programme together. Typically, each module will involve students in 72 hours of scheduled contact except Mathematics for which students will have 96 hours of scheduled contact for each module. An expected weekly attendance commitment will be around 21 hours.

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.

We use CANVAS to share course materials and reading lists, communicate with students, track student participation, facilitate discussions, support formative and summative assessments and provide feedback.

Students can use Canvas independently to revise materials, ask questions and interact with lecturers and other students using discussions, practise and assess their understanding using quizzes, or for finding resources for further reading.

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.

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.

Equality, diversity, inclusion and ethics are embedded in our programme’s learning and teaching activities. We celebrate differences and ensure that everyone has equal opportunities to achieve their desired outcomes. Students will be encouraged to explore a diverse range of digital technologies and theories, and engage constructively with businesses and communities to enrich their understanding of the impact of Cyber Security on everyone's everyday lives and embrace the values of equality, diversity and inclusion in their development of Cyber Security solutions. This approach will equip students with the wider perspective of the relevance of Computer Science for Cyber Security for the betterment of businesses and society.

## Assessment Strategy

Methods of assessment are similarly 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.

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 School that culminated in a journal publication.

## Assessment Regulations

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

## Admission Requirements

The University welcomes applications from all potential students and most important in the decision to offer a place is our assessment of a candidate's potential to benefit from their studies and of their ability to succeed on this particular programme. Consideration of applications will be based on a combination of formal academic qualifications and other relevant experience.

The minimum entry requirements for the programme are as follows:

A typical offer to someone seeking entry through the UCAS scheme would be 72 UCAS points, a minimum of GCSE Maths grade B/grade 6 and GCSE English grade D/grade 3 (equivalents accepted) although having post GCSE Maths and/or Physics (A level) would be an advantage.

The UCAS tariff applicable may vary, and the programme details are published at:

http://www.bradford.ac.uk/study/courses/info/engineering-with-foundation-year-beng

Applications are welcome from students with non-standard qualifications or mature students (those over 21 years of age on entry) with significant relevant experience.

The University of Bradford has always welcomed applications from disabled students, and these will be considered on the same academic grounds as are applied to all applicants. If applicants have some form of disability, then they may wish to contact the Programme Leader before they apply.

Applications are welcome from students with non-standard qualifications or mature students (those over 21 years of age on entry) with significant relevant experience and will be considered on individual basis by academic tutors.

## Recognition of Prior Learning

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.

## Minor Modification Schedule

| Version Number | Brief description of Modification | Date of Approval (Faculty Board) |
|---|---|---|
| 1 | Specification reformatted and made accessible | December 2020 |
| 2 | Learning outcomes updated | July 2021 |
| 3 | Amendments for 2021 Academic Year | August 2021 |
| 4 | Updates for periodic review | April 2023 |