

## **BEng (Hons) Software Engineering Programme Specification**

Academic Year:	2021/22
Degree Awarding Body:	University of Bradford
Final and interim award(s):	<p>BEng (Honours) Software Engineering [Framework for Higher Education Qualifications (FHEQ) level 6]</p> <p>BEng Software Engineering – exit award [Framework for Higher Education Qualifications (FHEQ) level 6]</p> <p>Diploma of Higher Education Software Engineering [Framework for Higher Education Qualifications (FHEQ) level 5]</p> <p>Certificate of Higher Education Software Engineering [Framework for Higher Education Qualifications (FHEQ) level 4]</p>
Programme accredited by (if appropriate):	BCS The Chartered Institute for IT
Programme duration:	3 years full-time; 4 years full-time including a year of study abroad and/or work placement.
UCAS code:	<p>I300 (3-years)</p> <p>I301 (4-years)</p>
QAA Subject benchmark statement(s):	Computing, Engineering
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

Software Engineering is concerned with building computer systems that are error free and totally reliable, such as safety critical systems in aircraft, industrial plants, smart cities and healthcare. The general principles of engineering are applied to the production of software that meets these stringent requirements. The early part of the programme concentrates on the general and theoretical foundations of computer science, problem analysis and solving, and professional skills with a further focus on software engineering topics. It incorporates ideas from many other disciplines, including mathematics, engineering and management and has a close affinity with information and communication technologies as illustrated by the Internet and World Wide Web. The term 'convergence' is often used to describe how these disciplines are coming together, and this is how the software engineering programming builds also on. Later, the emphasis moves to the design, implementation, testing and administration of large software engineering projects.

The BEng (Hons) Software Engineering is offered by the Department of Computer Science, part of the Faculty of Engineering and Informatics (EI) 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.

Exposure to industry is deeply embedded within this programme in a number of ways. The programme is industry informed with our Industry Advisory Board (IAB), a membership comprised of industry representatives from both regional and national companies, reviewing our provision of the programme and advising on our programme enhancements. The launch of the Computing Enterprise Centre offers to our students the opportunity to develop industry-based projects in the second and final years and provides also industry-sponsored competitive internships. We support industry placements and collaborate with local, national and international organisations offering such job offers through our industry contacts and extended network of successful graduates.

The undergraduate and postgraduate programmes offered by our Department are accredited by or aligned to professional bodies including the British Computer Society (BCS), The Chartered Institute for IT and computing professionals, the Association of Computing Machinery (ACM) and GCHQ. The accreditation of our programmes means that successful honours graduates are exempted from further examinations for professional memberships and ensures that our graduates are not only exposed to industry throughout their course but also are employment ready upon graduation.

The student societies with links to professional bodies afford further opportunities for students to engage with industry, such as the student Computing Society Pi Soc as the first ever BCS Student Chapter, and our ACM Student Chapter. The Department encourages and offers support to these societies in their participation in industry and research led activities including programming competitions, data dives and extra-curricular collaborations and visits.

Our placement scheme also provides students with the opportunity to work in a company for up to one year as part of their studies.

The Department also places great emphasis on research and research-informed teaching, and there are opportunities for students to join one of our research teams and their projects, and progress on to postgraduate taught programmes or research degrees on completion of their first degree.

## **Programme Aims**

The aims of the programme are to provide students with a sound grounding in the fundamentals of computer science, software development (programming) and the tools and applications used by software engineers, and to provide the skills needed to enable them to practice as a professional software engineer. These aims 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 wide range of options, particularly in the final stage, so that they may choose the particular area in which they are strong or wish to specialise, building on the knowledge and understanding gained earlier.

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 so that during studies and on graduation students 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 adequate solutions to large-scale real-life problems by adapting and applying fundamental principles and concepts of software engineering, such as languages, tools, techniques, methodologies, standards, quality assurance systems, organisation and management methods.

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 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 skills 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 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 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 Software Engineering.

PLO 16 Deploy accurately established techniques of analysis and enquiry within Software Engineering.

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 Software Engineering.

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 software engineering including detailed knowledge of hardware, computer architecture, information and communication technologies.

PLO 20 Build complex software systems using state of the art software design and development methods; apply various testing techniques to validate the requirements of a wide range of software systems.

PLO 21 Use software technologies to design and develop large-scale database applications.

PLO 22 Apply concepts and principles in key computing subjects, including data and information security and forensics, information systems, large scale databases, communication networks, and parallel and distributed systems.

PLO 23 Demonstrate professional interest and expertise for a variety of careers such as software engineer, software designer and software architect, software developer, system administrator, IT project manager, IT consultant or computing researcher that match both learners and employers expectations.

PLO 24 Show a firm grasp of the mathematical foundations of computing and how they underpin the formal specification and design of large commercial or research applications.

PLO 25 Analyse problems and develop solutions using leading edge ideas and techniques

PLO 26 Have competence in the use of major software application packages.

PLO 27 Exercise initiative in information management, interpretation and presentation of Software Engineering tools, products and solutions.

## Curriculum

### Stage 1 (Level 4)

FHEQ Level	Module Title	Type (Core/Option)	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	System Security Management	C	20	2	COS5017-B
5	Enterprise-Pro	C	20	2	COS5019-B
5	Computer Communications and Networks	C	20	2	COS5025-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	Large Scale Data Driven Applications	C	20	1	COS6009-B
7	Mobile Application Development	O	20	1	COS7025-B
6	Numerical Methods and Computer Graphics	O	20	1	COS6021-B
6	Human Computer Interaction	O	20	1	COS6029-B
6	Software Systems Design and Testing	C	20	2	COS6028-B
6	Machine Learning	O	20	2	COS6026-B
6	Concurrent and Distributed Systems	O	20	2	COS6012-B
6	Principles of Security Technologies	O	20	2	COS6025-B

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.

THIS AWARD CONFERS ELIGIBILITY TO REGISTER WITH BCS

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 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, 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/>

## Learning and Teaching 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 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.

Each 20-credit module on the programme requires students to commit 200 hours of study. 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 students 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.

In addition, the learning and teaching on the programme are informed by industry and by staff undertaking KTP projects, national and EU funded research projects and consultancy work that embed new knowledge and concepts into our teaching materials and curriculum planning; and inviting industrial speakers. Throughout the academic year industry speakers and researchers are also invited to give talks and lectures that inform and inspire our students about current and future developments within their disciplines.

Cutting edge projects initiated by industry are also embedded within a number of the modules, such as Technical and Professional Skills (level 4), Enterprise-Pro (level 5) and Final Year Project (level 6), through our Computing Enterprise Centre, allowing students to work on topics that are highly relevant to their future careers throughout the course.

Students will also have the opportunity to interact with our Independent Computing Industry Advisory Board members and a wider audience of industry contacts during the Final Year Project Showcase, which allows them to demonstrate their work and to receive feedback and ideas from professionals within the discipline.

Further, the programme employs a number of innovative and active learning methods. For example, Team Based Learning (TBL) strategies are integrated within a number of the modules. We also endeavour to use team teaching methods where lecturing staff are able to contribute their 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 Enterprise-Pro module (level 5) requires and supports students to develop their projects using an industry standard tool for collaborative team-based software development. This allows students to develop industry standard skills based on real working practice.

All of our staff have achieved, or are working towards, Fellowship of the Higher Education Academy (FHEA). 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.

Our curriculum development is informed by the research conducted by academic members of staff within the Department, exposing students to the cutting-edge developments within the related fields of expertise. Knowledge and experience from Industrial partners are also integrated within the programme 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 Regulations, available at the following link: [www.bradford.ac.uk/regulations](http://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.

The minimum entry requirements for the programme are as follows:

GCSE English Language and Maths minimum grade C or grade 4, or equivalent qualifications.

The UCAS tariff applicable may vary and is published here:

<https://www.bradford.ac.uk/courses/ug/software-engineering-beng/>

Please note: This link provides admission information relevant to the current recruitment cycle and therefore may be different to when this document was originally published.

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 might 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)
2	Updates for Periodic Review Nov 2015	
3	Updates to address comments received from the panel of APR	
4	Minor Modification November 2016	
5	Modifications to curriculum structure	March 2019
6	Minor modifications to learning outcomes and module titles and introduction of additional optional module at level 6	March 2020
7	Specification reformatted and made accessible	December 2020
8	Learning Outcomes updated	July 2021
9	Changes for 2021 Academic Year	August 2021