UNIVERSITY of BRADFORD

Faculty of Engineering and Informatics

Department of Computer Science

Programme Specification

Programme title: BEng (Hons) Software Engineering

Academic Year:	2019/20
Degree Awarding Body:	University of Bradford
Partner(s), delivery organisation or support provider (if appropriate):	
Final and interim award(s):	**BEng (Honours) Software Engineering** [Framework for Higher Education Qualifications (FHEQ) level 6] **BEng Software Engineering** – exit award [Framework for Higher Education Qualifications (FHEQ) level 6] **Diploma of Higher Education Software Engineering** [Framework for Higher Education Qualifications (FHEQ) level 5] **Certificate of Higher Education Software Engineering** [Framework for Higher Education Qualifications (FHEQ) level 4]
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:	I300 (3-years) I301 (4-years)
QAA Subject benchmark statement(s):	Computing, Engineering
Date last confirmed and/or minor modification approved by Faculty Board	March 2019

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 the safety critical systems in aircraft, industrial plants, smart cities or 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, 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 School of Electrical Engineering and 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 School 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. Employment prospects for graduates of the BEng Software Engineering should be excellent. Our BCS-accredited programmes consistently enjoy a 91% graduate employment rate.

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 School 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 School 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:

1. 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 specialize, building on the knowledge and understanding gained earlier.
2. 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 Electrical Engineering and 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.
3. 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.
4. 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.
5. 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:

LO1 Describe the history of computer science
LO2 Outline the professional, ethical, security, industrial and research dimensions of the discipline of computer science
LO3 Demonstrate knowledge of fundamental concepts and theories of software engineering, and the environment in which they operate; basics of software development and the tools required to support it, enhance skills in constructing complex software solutions.
LO4 Demonstrate an understanding of and ability to apply fundamental concepts, principles and theories underpinning computing to real-world situations.
LO5 Collect, organise and present information related to software systems using appropriate methods and techniques.

LO6 Plan, undertake and report appropriate case studies within a computing environment.
LO7 Apply standard software engineering methods for case studies in various fields.
LO8 Work effectively as individuals and in groups. Use personal skills to communicate effectively in a range of situations.
LO9 Communicate accurately and reliably with a range of audiences using basic theories and concepts of the subjects of study.

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

LO10 Apply methods, methodology, knowledge, skills and standards to build complex software systems.
LO11 Apply knowledge of investigative and research principles to demonstrate an understanding of how to evaluate computing designs, processes and products.
LO12 Apply key concepts on planning, requirements engineering, design, implementation, testing, maintenance and quality assurance.
LO13 Apply software engineering principles to analysis, assessment and management of specific problems and challenges.
LO14 Use practical computing skills in the design and manufacture, testing, validation and verification of computer systems.
LO15 Use personal and technical skills to communicate effectively within computing environments in partnership with other professionals.

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

LO16 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.
LO17 Build an ability to deploy accurately established techniques of analysis and enquiry within Software Engineering.
LO18 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.
LO19 Demonstrate an appreciation of the uncertainty, ambiguity and limits of knowledge.
LO20 Manage and communicate their own learning, and to make use of primary sources.

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

LO21 Show a systematic understanding of the fundamental concepts and theories of software engineering including detailed knowledge of hardware, computer architecture, information and communication technologies.
LO22 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.

LO23 Comment on aspects of current research in the discipline.
LO24 Analyse problems and develop solutions using leading edge ideas and techniques.
LO25 Read and make use of research articles in journals and research literature; competence in the use of major software application packages.
LO26 Exercise initiative in information management, interpretation and presentation of Software Engineering tools, products and solutions.
LO27 Apply technical skills to specify and verify requirements of a wide-range of software systems, and analyse and test correctness of safety-critical systems.
LO28 Use software technologies to design and develop applications for mobile and networked device.
LO29 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
LO30 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.

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
7	Mobile Application Development	C	20	1	COS7025-B
6	Numerical Methods and Computer Graphics	O	20	1	COS6021-B
6	Large Scale Data Driven Applications	O	20	1	COS6009-B
6	Software Verification and Testing	C	20	2	COS6027-B
6	Machine Learning	O	20	2	COS6026-B

FHEQ Level	Module Title	Core/ Option/ Elective	Credits	Semester (s)	Module Code
6	Elective*	O	20	2	
6	Concurrent and Distributed Systems	O	20	2	COS6012-B

* Choice for Elective is one 20-credit module at level 6 with no timetable clashes once in programme.

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.

Students who achieve an Ordinary degree may be given the opportunity to 'top-up' to a classified Honours degree at a later stage at which time they will undertake the individual project.

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. For further information on industry talks and research seminars please refer to:

http://www.bradford.ac.uk/ei/electrical-engineering-and-computer-science/research/research-seminars/

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 School that culminated in a journal publication.

Our curriculum development is informed by the research conducted by academic members of staff within the School, 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 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.

Assessment Regulations

This Programme conforms to the standard University Regulations, available at the following link:

http://www.bradford.ac.uk/aqpo/ordinances-and-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 total of 128 UCAS tariff points, to include 80 points from 2 GCE A levels or equivalent. At least one from Computing, ICT, Maths or a science is preferred. Or DDM in a relevant BTEC Diploma. International Baccalaureate (see UCAS tariff point requirements).
- GCSE English and Maths minimum grade C or grade 4, or equivalent qualifications.

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