Introduction

Software Engineering is concerned with building computer systems that are error free and totally reliable, such as the safety critical systems in aircraft or industrial plant. 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 theoretical foundations of computation and computer technology. It incorporates ideas from many other disciplines, including mathematics, engineering, psychology and graphical design and has a close affinity with electronic communications as illustrated by the Internet and World Wide Web. The term ‘convergence’ is often used to describe how these two disciplines are coming together. Later the emphasis moves to the design and implementation of large software engineering projects.

The BEng Software Engineering is offered by the School of Electrical Engineering and Computer Science, part of the Faculty of Engineering and Informatics (SEI) in the University of Bradford, which includes a large number 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 you to join one of our research teams and progress on to postgraduate taught programmes or research degrees on completion of your first degree. Note that the British Computer
Society (BCS) for computing professionals, the route to further professional qualifications, accredits undergraduate and postgraduate programmes offered by the School. Its accreditation of our programmes, including the BEng Software Engineering, also means that successful honours graduates are exempted from further examinations for BCS membership. Employment prospects for graduates of the BEng Software Engineering should be excellent – our BCS-accredited programmes currently enjoy a 91% graduate employment rate.

**Programme Aims**

The aims of the programme are to provide you with a sound grounding in the fundamentals of computer software development (programming) and the tools and applications used by software engineers, and to provide the skills needed to enable you to practice as a professional software engineer. These aims will be achieved by:

- Providing you 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 you may choose the particular area in which you are strong or wish to specialize, building on the knowledge and understanding gained earlier.
- Providing the support in the form of lectures, labs and tutorials that will enable you to develop your personal portfolio of skills.
- Developing discipline skills and personal transferable skills so that on graduation you may move directly into responsible positions in industry or commerce, or may pursue further programmes of study.
- Promoting educational opportunities for ethnic minorities, women, mature and alternatively qualified students, as well as for school-leavers and traditionally qualified students.

**Programme Learning Outcomes**

Learning outcomes indicate what you should know, understand and be able to do on successful completion of your programme. Software Engineering is a subject where current practices in the field are changing rapidly as technologies evolve and new programming languages emerge. However the underlying theory and principles do not change rapidly. You will study these fundamentals and learn how to apply them to the analysis of problems and how to plan, implement and evaluate the solutions. You will learn about new technologies and languages required to implement solutions. In order to achieve the learning outcomes you will develop the following:

- **Knowledge and Understanding**: a systematic understanding of the fundamental concepts and theories of computer science including detailed knowledge of hardware, computer architecture, information and communication technologies; a firm grasp of the mathematical foundations of computing and how they underpin the formal specification and design of commercial applications; knowledge of the engineering principles associated with large software projects; an awareness of and concern for the need for software reliability, correctness and safety, such concern being the hallmark of a professional software engineer; ability to comment on aspects of current research in the discipline.
• **Discipline Specific Skills** including; how to analyse problems and develop solutions using leading edge ideas and techniques; how to develop computer programs using object oriented programming languages; how to choose which programming languages to use for specific applications; ability to manage and/or contribute to a team approach to software engineering projects; an ability to read and make use of research articles in journals and research literature; the ability to complete a major individual software engineering project; competence in the use of major software application packages.

**Personal and Transferable Skills:** exercise of initiative in information management, interpretation and presentation; ability to make decisions in a variety of contexts; application of IT and communications skills to management problems; report writing and presentation skills; creative and systematic problem solving; teamwork and leadership; project management; and personal management.

On completion of this award at Certificate of Higher Education level, you will be able to:

1. Demonstrate a core underpinning knowledge related to computer science.
2. Demonstrate an understanding of and ability to apply fundamental concepts, principles and theories underpinning computing to straightforward situations.
3. Collect, organise and present data using appropriate techniques, analysing simple computing problems in specific areas.
4. Demonstrate and apply basic knowledge of the principles of research design, and data collection and skills, to support design.
5. Plan, undertake and report a simple investigation within a computing environment.
6. Apply standard laboratory and other methods to obtain and interpret accurate data.
7. Work effectively as individuals and in groups. Use personal skills to communicate effectively in a range of situations.
8. Communicate accurately and reliably with a range of audiences using basic theories and concepts of the subjects of study.

On completion of this award at Certificate of Higher Education level, you will be able to:

1. Apply knowledge and skills in computing to the analysis of complex software design data.
2. Apply knowledge of investigative and research principles to demonstrate an understanding of how to evaluate designs, processes and products.
3. Apply knowledge of relevant software to problems and system.
4. Apply knowledge of software engineering to the assessment and management of specific problems and challenges.
5. Demonstrate the use of practical computing skills in design and manufacture, testing and fault diagnosis.
6. Use personal and technical skills to communicate effectively within computing environments in partnership with other professionals.

Although the University does not recruit directly to Ordinary degrees this route is available.
A Bachelor's degree (Ordinary) is awarded to students who have demonstrated:

- a systematic understanding key aspects of their field of study, including acquisition of coherent and detailed knowledge informed by aspects of Software Engineering.
- an ability to deploy accurately established techniques of analysis and enquiry within Software Engineering.
- conceptual understanding that enables the student:
  - to devise and sustain arguments, and/or to solve problems, using ideas and techniques.
  - to describe and comment upon particular aspects of current research, or equivalent scholarship, or practice in Software Engineering.
- an appreciation of the uncertainty, ambiguity and limits of knowledge.
- the ability to manage their own learning, and to make use of primary sources.

Typically, holders of the qualification will be able to:

- apply the methods and techniques that they have learned to review, consolidate, extend and apply their knowledge and understanding.
- communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

And holders will have:

- the qualities and transferable skills necessary for employment requiring:
  - the exercise of initiative and personal responsibility
  - the learning ability needed to undertake appropriate further training of a professional or equivalent nature.

Curriculum

The map of your studies is detailed below showing core (C) and optional (O) modules. Each year, or stage, of an Honours programme comprises two semesters with 60 credits being studied in each semester. For 20 credit double modules (last character in module code is a ‘D’) all of the teaching and assessment is undertaken in the same semester. For 20 credit linked modules (last character in the module code is an ‘L’) and the 40 credit project there is teaching and assessment in both semesters. Ordinary degrees comprise 100 credits in each stage.

Stage 1 [FHEQ Level 4]

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Credit</th>
<th>Sem</th>
<th>Level</th>
<th>Module Title</th>
<th>Hons</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM0113L</td>
<td>20</td>
<td>1,2</td>
<td>4</td>
<td>Developing Professional Skills</td>
<td>C</td>
</tr>
<tr>
<td>CM0107L</td>
<td>20</td>
<td>1,2</td>
<td>4</td>
<td>Computer Architecture and Systems Software</td>
<td>C</td>
</tr>
<tr>
<td>CM0111L</td>
<td>20</td>
<td>1,2</td>
<td>4</td>
<td>Formal Foundations</td>
<td>C</td>
</tr>
<tr>
<td>CM0130L</td>
<td>20</td>
<td>1,2</td>
<td>4</td>
<td>Fundamentals of Internet Technology</td>
<td>C</td>
</tr>
<tr>
<td>CM0116D</td>
<td>20</td>
<td>1</td>
<td>4</td>
<td>Software Development (Part 1)</td>
<td>C</td>
</tr>
<tr>
<td>CM0117D</td>
<td>20</td>
<td>2</td>
<td>4</td>
<td>Software Development (Part 2)</td>
<td>C</td>
</tr>
</tbody>
</table>

Students who have achieved at least 120 credit points at Level 4 may exit the programme and are eligible for the award of Certificate of Higher Education.
### Stage 2 [FHEQ Level 5]

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Credit</th>
<th>Sem</th>
<th>Level</th>
<th>Module Title</th>
<th>Hons</th>
<th>Ord</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM0229L</td>
<td>20</td>
<td>1,2</td>
<td>5</td>
<td>Database Systems</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>CM0228L</td>
<td>20</td>
<td>1,2</td>
<td>5</td>
<td>Software Engineering with Group Project</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>CM0316L</td>
<td>20</td>
<td>1,2</td>
<td>5</td>
<td>Data Structures and Algorithms</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>CM0315L</td>
<td>20</td>
<td>1,2</td>
<td>5</td>
<td>Computer Communications and Networks</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>CM0305L</td>
<td>20</td>
<td>1,2</td>
<td>5</td>
<td>Information Systems Analysis and Design</td>
<td>C</td>
<td>O</td>
</tr>
<tr>
<td>CM0223L</td>
<td>20</td>
<td>1,2</td>
<td>5</td>
<td>Electronic Business</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

Students who have achieved at least 120 credit points at Level 5 may exit the programme and are eligible for the award of Diploma of Higher Education.

### Stage 3 [FHEQ Level 6]

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Credit</th>
<th>Sem</th>
<th>Level</th>
<th>Module Title</th>
<th>Hons</th>
<th>Ord</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM0347K</td>
<td>40</td>
<td>1,2</td>
<td>6</td>
<td>Final Year Project OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM0341Q</td>
<td>40</td>
<td>1,2</td>
<td>6</td>
<td>Final Year Project (UAS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honours and Ordinary</td>
<td></td>
<td></td>
<td></td>
<td>W: Mobile Systems (after CM0315L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM0504D</td>
<td>20</td>
<td>1</td>
<td>6</td>
<td>Information Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM0332D</td>
<td>20</td>
<td>1</td>
<td>6</td>
<td>Formal Methods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM0606D</td>
<td>20</td>
<td>1</td>
<td>6</td>
<td>Decision Support Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EM0359D</td>
<td>20</td>
<td>1</td>
<td>6</td>
<td>Design for Mobile Content</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>CM0602D</td>
<td>20</td>
<td>1</td>
<td>7</td>
<td>Networks Performance Modelling and Analysis</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>CM0358D</td>
<td>20</td>
<td>1</td>
<td>6</td>
<td>Cyber Security</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>CM0328D</td>
<td>20</td>
<td>2</td>
<td>6</td>
<td>AI for Games</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>EM0240D</td>
<td>20</td>
<td>2</td>
<td>5</td>
<td>Multimedia Applications Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM0518D</td>
<td>20</td>
<td>2</td>
<td>6</td>
<td>Concurrent and Distributed Systems</td>
<td>O</td>
<td>C</td>
</tr>
<tr>
<td>CM0348D</td>
<td>20</td>
<td>2</td>
<td>6</td>
<td>Foundations of Cryptography</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>CM0331D</td>
<td>20</td>
<td>2</td>
<td>6</td>
<td>Human Computer Interaction (Design and Development)</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>CM0506D</td>
<td>20</td>
<td>2</td>
<td>6</td>
<td>Real Time Systems</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>CM0354D</td>
<td>20</td>
<td>2</td>
<td>6</td>
<td>Real Time Simulation and Modelling</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>CM0359D</td>
<td>20</td>
<td>2</td>
<td>6</td>
<td>Large Scale Data Driven Applications</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

Please note that, while every effort will be made to accommodate your choices, it may not be possible to permit every possible combination of optional modules, due to timetabling constraints. The curriculum may change, subject to the University’s programme approval, monitoring and review procedures.

In addition to a degree, successful completion of the Honours degree programme will give candidates a qualification that is recognized by the British Computer Society.
Study abroad and work placement opportunities

You have the option to undertake an industrial placement, or of studying or working abroad for a year between stages 2 and 3; this option is strongly encouraged. The School has an industrial training tutor who has contacts with a large number of outside organisations and who assists in helping you find a placement. The University’s International Office provides a wide range of opportunities and support for students to gain international experience. Both options provide the opportunity to gain valuable experience, and are viewed favourably by prospective employers.

Teaching and Assessment strategies

You will experience a wide range of teaching and learning environments. Concepts, principles and theories are generally explored in formal lectures, practiced in associated tutorials and seminars, and demonstrated in laboratory classes. Practical skills are developed in laboratory sessions. Professional and personal skills are developed through the Developing Professional Skills module which involves communications skills, library skills, group work and presentations. The Software Engineering Group Project develops an appreciation of how to manage group dynamics in whilst working on a substantial 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 you to demonstrate your ability to solve problems using current ideas and techniques that are at the forefront of computing and information systems 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 you to commit 200 hours of study. Some of these hours will be formally timetabled - lectures, laboratories, seminars and tutorials – and others will involve you in carrying out private study. The balance between these forms of study changes as you pass through the three years of the programme. There are a lot of “contact hours” (time spent with tutors) in the earlier stages of the programme; in the final year you will be expected to manage your own learning, under the general guidance of your tutors.

Methods of assessment are similarly varied and your 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 you may demonstrate the particular learning outcomes of each module.

Assessment Regulations

This Programme conforms to the standard University Regulations which are available at the following link: http://www.bradford.ac.uk/aqpo/ordinances-and-regulations/

Admissions Requirements

The University welcomes applications from all potential students regardless of their previous academic experience; offers are made following detailed consideration of
each individual application. 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. Entrance requirements for each programme will vary but consideration of your application will be based on a combination of your formal academic qualifications and other relevant experience. If you have prior certificated learning or professional experience which may be equivalent to parts of this programme, the University has procedures to evaluate this learning in order to provide you with exemptions from specified modules contained within the curriculum. Please talk to us if you do not fit the standard pattern of entry qualifications.

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. We are continually reviewing and developing our practices and policies to make the University more inclusive, but if you are disabled we may need to make some adjustments to make sure that you are not disadvantaged. We would advise you to contact the programme leader before you apply to discuss these.

In addition to a degree, successful completion of the Honours degree programme will give candidates a qualification that is recognized by the British Computer Society.

**Entry requirements:** Typical offer (UCAS tariff points): 260

- A total of 260 UCAS tariff points, to include 160 points from 2 GCE A levels or equivalent. At least one from Computing, ICT, Maths or a science is preferred. Or DMM in a relevant BTEC Diploma. International Baccalaureate (see UCAS tariff point requirements).
- GCSE English and Maths minimum grade C.
- For international students: minimum IELTS at 6.0 or the equivalent.

Offers are made following detailed consideration of each individual application. 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. Entrance requirements will vary but are set after consideration of each applicant’s academic background and achievements and all other relevant experience. A typical offer to someone seeking entry through the UCAS scheme would be 260 UCAS tariff points. However, applications are welcome from candidates with non-standard qualifications or who, lacking academic qualifications, have significant relevant experience.

**Learning Resources**

The JB Priestley Library on the city campus and our specialist library in the School of Management provide a wide range of printed and electronic resources to support your studies. We offer quiet study space if you want to work on your own, and group study areas for the times when you need to discuss work with fellow students. Subject librarians for each School provide training sessions and individual guidance in finding the information you need for your assignment, and will help you organise your references properly.
Student PC clusters can be found in both our libraries and elsewhere on the campus. Many of these are open 24/7. You can also use the University's wireless network to access the internet from your own laptop. Most of our journals are available online (both on and off campus), and you can also access your University email account, personal information and programme-related materials this way.

Staff are on hand during the daytime to help you if you get stuck, and there is a 24/7 IT helpline available.

**Student Support and Guidance**

**Programme Team**

All students admitted to the School of Electrical Engineering and Computer Science go through a process of induction that includes detailed talks by the Dean and Head of School.

Support for you personally and in your programme of study, will be provided both by the University and the Programme Team. You will be allocated a personal tutor who is someone with whom you will be able to talk about any academic or personal concerns. The School will ensure that there is someone available with whom you feel comfortable to help and support you. You will be provided with a comprehensive series of handbooks that you can consult on a range of learning issues and your programme tutors will be available to consult on subject specific queries.

**The Hub, Student Support Centre**

The Hub, Student Support Centre provides a central reception where students can receive information, advice and guidance on a whole range of topics about their life at University. The Hub is located in the Richmond Building adjacent to the Atrium.

The teams located within The Hub:

- **Accommodation**
- **Admissions**
  - Education Liaison
  - Enquiries
- **Student Administration and Support**
  - Bursaries and Financial Support
  - Finance and Credit Control Group
  - Payzone
  - Records and Tuition Fees
- **International Office**
- **Customer Service Team**

[www.brad.ac.uk/hub](http://www.brad.ac.uk/hub)
+44 1274 232233
Students’ Union
We value the feedback provided by students and collaborate with the Students’ Union, through a system of Student representatives and formal staff student liaison committees, so that any issues you wish to raise are addressed rapidly. The Students Union provide professional academic representation and advice. The Students’ Union and the University of Bradford work in partnership to provide confidential counselling and welfare services where you can get help with any aspect of your personal or academic life. Student Financial and Information Services (based in the Hub) will provide you with information about a diverse range of issues such as council tax, personal safety and tourist information. International Students can access a range of additional advice and support services through the Student’s Union.

Employability and Career Development
The University is committed to helping students develop and enhance their employability profile and capabilities through learning opportunities embedded within the curriculum.

Furthermore, the University is committed to supporting students to develop their commitment towards a career pathway(s) and to implementing a career plan. Professional career guidance and development support is available throughout your time as a student and as a graduate from Career Development Services. The support available from Career Development Services includes a wide range of information resources, one to one appointments, a weekly workshop programme, a mentoring programme, graduate recruitment and careers fairs, plus information and help to you find part time work, summer work placements, graduate internship programmes and graduate entry vacancies. In addition, some students as part of their programme of study may have the opportunity to complete a Career & Personal Development accredited module delivered by the Career Development Service.

All students are encouraged to access Career Development Services at an early stage during their studies and to use the extensive resources available on their web site www.careers.brad.ac.uk.

Career Development Services annually undertakes a survey of all graduates to find out their destination six months after graduation. The survey gathers data on the employment and further study routes graduates have entered and a range of other information including job roles, name and location of employers, salary details etc. The survey findings for each programme of study are presented on the programme information pages on the University website and via Career Development Services’ website www.careers.brad.ac.uk

Learner Development Unit for Academic Skills Advice
For undergraduate students who are looking to improve their marks during their time at University, study skills and maths advice is available to all regardless of degree discipline or level of study. Students can access a programme of interactive workshops and clinics which is delivered throughout the year. This is in addition to
our extremely popular face-to-face guidance from our advisers, who also offer a wide range of online and paper based materials for self-study.

http://www.bradford.ac.uk/academic-skills/

Disability

Disabled students will find a supportive environment at Bradford where we are committed to ensuring that all aspects of student life are accessible to everyone. The Disability Service can help by providing support, advice and equipment to help you get the most out of your time at Bradford. It is a place where you can discuss any concerns you may have about adjustments that you may need, whether these relate to study, personal care or other issues.

For more information contact the Disability Service by phoning: 01274 233739 or via email: disabilities@bradford.ac.uk

University policies and initiatives

Learning and Teaching

Our University approach to learning, teaching and assessment is encapsulated by an integrated set of themes and principles within our Curriculum Framework. All of our degree programmes have been designed to provide you with an inclusive and engaging learning environment which gives you the opportunity to thrive and develop in your area of study. Our research-informed programmes have a particular focus on developing your employability. We also place a strong emphasis on collaborative, real-world and enquiry-based learning, supported by appropriate learning technologies. Our assessment is designed not just to measure your achievement, but also to shape and guide your learning through preparing you for the increasing level of challenge as you progress through your degree. Together, these lead to you developing a distinctive set of graduate attributes which will prepare you for life beyond university.

Ecoverosity:

Ecoverosity is a strategic project of the University which aims to embed the principles of sustainable development into our decision-making, learning and teaching, research activities campus operations and lives of our staff and students. We do not claim to be a beacon for sustainable development but we aspire to become a leading University in this area. The facilities we create for teaching and learning, including teaching spaces, laboratories, IT labs and social spaces, will increasingly reflect our commitments to sustainable development. Staff and student participation in this initiative is crucial to its success and its inclusion in the programme specification is a clear signal that it is at the forefront of our thinking in programme development, delivery, monitoring and review. For more details see www.bradford.ac.uk/ecoversity

Further Information

For further information, please check the University prospectus or contact Admissions.

The Admissions Office
Disclaimer

The details of this Programme Specification and information contained therein are subject to change in accordance with the University of Bradford's programme approval, monitoring and review procedures.