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PROGRAMME SPECIFICATION

Course record information

Name and level of final award:	BEng (Honours) Software Engineering BEng (Honours) Software Engineering with Industrial Placement The BEng (Honours) Software Engineering is a Bologna FQ-EHEA first cycle degree
Name and level of intermediate awards:	BEng Software Engineering Diploma of Higher Education in Software Engineering Certificate of Higher Education in Software Engineering
Awarding body/institution:	University of Westminster
Teaching Institution:	University of Westminster
Status of awarding body/institution:	Recognised Body
Location of delivery:	Central London (Cavendish)
Language of delivery and assessment:	English
Mode, length of study and normal starting month:	3 years full time 4 years full-time with industry placement
QAA subject benchmarking group(s):	QAA subject benchmark for Computing British Computer Society guidelines on accreditation
Professional statutory or regulatory body:	British Computer Society (BCS)
Date of course validation/review:	February 2015
Date of programme specification approval:	January 2016
Valid for cohorts:	2016/17 for levels 4 and 5, 2017/18 for levels 4,5, 6
Course Leader	Dr Alexander Bolotov
UCAS code and URL:	http://www.westminster.ac.uk/courses/undergraduate

What are the minimum entry requirements for the course?

There are standard minimum entry requirements for all undergraduate courses. Students are advised to check the standard requirements for the most up-to-date information.

westminster.ac.uk/courses/undergraduate/how-to-apply

For most courses a decision will be made on the basis of your application form alone. However, for some courses the selection process may include an interview to demonstrate your strengths in addition to any formal entry requirements.

More information can be found here: westminster.ac.uk/courses/undergraduate/how-to-apply

Aims of the course

A software engineer is responsible for creating and maintaining secure and robust software applications. This involves applying a wide range of technologies and skills to formally design develop and test software to ensure that it satisfies the client's or stake holders' requirements. Students completing the course will have sufficient expertise to enter the highly dynamic and rapidly developing software industry productively, with a minimum of training. They will be able to operate effectively in a professional environment; they will learn quickly and will be ready to use new technologies. Moreover, they will be creative and based on the software engineering practice, will be able to produce ideas and solutions to make existing technologies more efficient, or to develop new technologies. These are only a few, but fundamental, features of the exciting modern software industry which, to a large extent, drives our society and which you, as a graduate from BEng (Honours) Software Engineering, will enter.

The BEng (Honours) Software Engineering has been designed to:

- provide students with knowledge and understanding of the fundamental principles and technologies of software engineering and general computer science;
- give students practical skills in the application of existing tools and techniques for the design and development of software;
- give students substantial experience of applying a systematic approach to software development and evaluation individually, or as members of a software team;
- make students aware of professional, ethical and legal issues that might arise in a software development environment;
- enable students to develop as independent and self-critical problem solvers;
- prepare students for continued study at an advanced level, either in formal postgraduate study or as continued professional development.

What will you be expected to achieve?
Learning outcomes are statements on what successful students have achieved as the result of learning. These are threshold statements of achievement the learning outcomes broadly fall into four categories:

- The overall **knowledge and understanding** you will gain from your course (KU).
- **Graduate attributes** are characteristics that you will have developed during the duration of your course (GA).

- **Professional and personal practice learning outcomes** are specific skills that you will be expected to have gained on successful completion of the course (PPP).

- **Key transferable skills** that you will be expected to have gained on successful completion of the course (KTS).

In the following list of Learning Outcomes, L4 refers to your first year of study, L5 refers to your second year of study, and L6 refers to your final year of study. Each statement in the list describes a course learning outcome (statement of achievement) and its associated domain as described in the table below.

Code	Domain	Description
C	Client-User Focused	Associated with the user interface and usability of systems. Focused on the client component of systems.
D	Data	Relates to knowledge and application of the processing and storage of information.
M	Maths	Relates to mathematical skills and knowledge.
O	Operating Environment	Relates to knowledge and understanding of the environment in which users run application software.
P	Programming	Relates to programming and development skills.
S	Skills	Relates to professional and practical skills.

For example: **L4-M-LO1-SE** means

L4, this at level 4 (first year)
M, it relates to Mathematics domain
SE, the course code i.e. Software Engineering.

Level 4 learning outcomes
Upon completion of level 4 you will be able to:

L4-M-LO1-SE - Analyse small scale problems and design their solutions by applying algorithmic and mathematical techniques.

L4-M-LO2-SE - Apply core mathematical elements to solve algorithmic problems.

L4-P-LO3-SE - Apply programming principles and constructs to implement solutions to small scale problems.

L4-D-LO4-SE - Methodically capture user requirements and create a specification that meets them.

L4-D-LO5-SE - Describe, create and manipulate simple data collections and understand how information is represented in information systems.

L4-O-LO6-SE - Describe the structure of a computing system, the design of its basic components and explain the interactions of hardware and software components.

L4-C-LO7-SE - Use appropriately the client-server architecture with respect to client design and security implications.

L4-S-LO8-SE - Recognise and explain behaviour constraints of a professional code of conduct towards third parties in a Software Engineering working environment.

L4-S-LO9-SE - Following guidance, review literature in Software Engineering and present in written and oral form own work and learning, critically comparing, contrasting and evaluating the findings.

Level 5 learning outcomes
Upon completion of level 5 you will be able to:

L5-M-LO1-SE - Demonstrate competency in object-oriented design and algorithmic and mathematical approaches to solve medium scale problems.

L5-M-LO2-SE - Analyse algorithms and their complexity and apply relevant strategies in designing and re-using algorithms.

L5-P-LO3-SE - Utilise, compare and contrast software frameworks and architectures and implement solutions using object-oriented programming.

L5-D-LO4-SE - Demonstrate how information is modelled, persistently stored, manipulated and retrieved, as data, to serve scalable solutions to medium-scale object-oriented problems.

L5-D-LO5-SE - Employ a standard modelling language for the design, representation and formal specification of software.

L5-O-LO6-SE - Explain the basic principles of modern operating systems and how they serve operational needs.

L5-C-LO7-SE - Identify and explain security risks and their implications for computer systems.

L5-C-LO8-SE - Identify, evaluate, and improve on interface issues between human users and computer systems using multiple platforms.

L5-S-LO9-SE - Demonstrate professional responsibility in the development of quality software engineering solutions in a global context and the presentation and defence of these in multiple communication forms, supported by methodical research.

Level 6 learning outcomes
Upon completion of level 6 you will be able to:

L6-M-LO1-SE - Methodically and independently develop requirements to a solution for a large scale software problem using appropriate languages and tools.

L6-D-LO2-SE - Design large scale data systems to discover hidden relationships and automate and/or inform decision making.

L6-C-LO3-SE - Identify and appraise the main threats to computer systems and networks security and integrity.

L6-S-LO4-SE - Demonstrate complete handling of the full life-cycle of a software engineering project underpinned by an entrepreneurial approach and a focus on the needs of real clients and the wider society.

L6-S-LO5-SE - Apply appropriate research methodologies in carrying out independent research in software engineering and produce a report demonstrating evidence of critical thinking.

How will you learn?

In your course you will have a wide selection of learning and using them will help you mature in attitude and competence, preparing you for your future career and life in general. Learning in your course is a partnership: expert University staff will guide you through the necessary core knowledge of your subject and help you develop an understanding, while you, increasingly, take the leading role in pursuing the learning that meets your specific needs.

Your course is organised into a number of **modules** at each level. These are the building blocks of your course. Each module consists of a number of learning activities over a number of weeks designed to help you achieve the knowledge and skills related to a particular area within your subject.
The principal aim of your course is to equip you for professional life, or further study, relevant to your current programme of study. To prepare you for this, the learning in your course will not take place only in the scheduled class. Your learning will use four methods, each supporting the others:

- **Lectures** will give you access to expertise and present you with the knowledge you need in your subject.
- **Practical tutorial or laboratory sessions** will allow you to understand, apply and strengthen your skills under the guidance of a tutor.
- **Independent study time** will let you take more control of your own learning and give you the framework that will help you to keep on learning without supervision.
- **Personal development** will allow you to complement your knowledge with the specific specialised skills that meet your individual needs.

In your first year of study (called **Level 4**) you will make the full transition into Higher Education. You will develop the key core skills for Software Engineering complemented with the foundations of your specific course or pathway. To help this transition your course has additional classes and support sessions at this level that you will need to fully engage with so you can prepare for the advanced study that follows.

Your second year of study (**Level 5**) will help you develop some autonomy. At this level you will develop detailed knowledge in Software Engineering and will be able to deal with more areas by yourself and in teams, reflecting on your own strengths and identifying areas to specialise in. Following that level you may choose to have a year in industry (a **placement year**) to strengthen your understanding of industry needs through direct application of your evolving skills.

Your third year of study (**Level 6**) you will have learned to work autonomously with your lecturers increasingly being there to support you and challenge your thinking; this is the level that completes your preparation for going into industry and further study, with an ability to handle the complexity of large-scale systems and environments and with full control of your further development needs.

Throughout all levels of your course you will also develop necessary, distinct, attributes that will help you compete effectively in a global changing environment.

The Graduate Attributes (GA) are developed throughout the course through the knowledge and professional skills modules, and are intended to ensure that you have a deep knowledge of the subject area, you are critical and creative thinkers, are professional, socially, ethically and environmentally aware, global in outlook and community engaged, and a literate and effective communicator. The table below maps these key attributes to the core course modules.

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Level 4

Graduate Attributes	Themes	Learning outcomes
Critical and creative thinkers	Mathematical modelling and problem solving	Analyse small scale problems applying algorithmic and mathematical techniques.
		Apply core mathematical elements to solve algorithmic problems
	Programming	Apply programming principles and constructs to implement solutions to small scale problems.
	Data modelling	Methodically capture user requirements and create a specification that meets them.
		Describe, create and manipulate simple data collections through their underlying representation.
Global in outlook and community engaged, Socially, environmentally and ethically aware	Operating environment	Describe the structure of a computing system, the design of its basic components and explain the interactions of hardware and software components.
	Meeting client needs	Use appropriately the client-server architecture with respect to client design and security implications.
Socially, environmentally and ethically aware	Professional practice	Recognise and explain behaviour constraints of a professional code of conduct towards third parties in a Software Engineering working environment.
Literate and Effective Communicator		Following guidance, review literature in Software Engineering and present in written and oral form own work and learning, critically comparing, contrasting and evaluating the findings.

Level 4 modules

Programming Principles I , II	Computer Systems Fundamentals	Web Design & Development	Computer Science Practice	Mathematics for Computing

Level 5

Graduate Attributes	Themes	Learning outcomes
Critical and creative thinkers	Mathematical modelling and problem solving	Demonstrate competency in object-oriented design and algorithmic and mathematical approaches to solve medium scale problems.
		Analyse algorithms and their complexity and apply relevant strategies in designing and re-using algorithms.
	Programming	Utilise, compare and contrast software frameworks and architectures and implement solutions using object-oriented programming.
	Data modelling	Demonstrate how information is modelled, persistently stored, manipulated and retrieved, as data, to serve scalable solutions to medium-scale object-oriented problems.
		Employ a standard design language for the design, representation and formal specification of software.
Global in outlook and community engaged, Socially, environmentally and ethically aware	Operating environment	Explain the basic principles of modern operating systems and how they serve operational needs.
	Meeting client needs	Identify, evaluate, and improve on interface issues between human users and computer systems using multiple platforms.
		Identify and explain security risks and their implications for computer systems.
Socially, environmentally and ethically aware Literate and Effective Communicator	Professional practice	Demonstrate professional responsibility in the development of quality software engineering solutions in a global context and the presentation and defence of these in multiple communication forms, supported by methodical research.

Level 5 modules

Object Oriented Programming	Client-Server Architectures	Software Development Group Project	Algorithms: Theory, Design and Implementation	Database Systems

Level 6

Graduate Attributes	Themes	Learning outcomes
Critical and creative thinkers	Mathematical modelling and problem solving	Methodically and independently develop requirements to a solution for a large scale software problem using appropriate languages and tools.
	Data modelling	. Design large scale data systems to discover hidden relationships and automate and/or inform decision making.
Global in outlook and community engaged, Socially, environmentally and ethically aware	Meeting client needs	Identify and appraise the main threats to computer systems and networks security and integrity.
Socially, environmentally and ethically aware,	Professional practice	Demonstrate complete handling of the full life-cycle of a software engineering project underpinned by an entrepreneurial approach and a focus on the needs of real clients and the wider society.
entrepreneurial Literate and Effective Communicator		Apply appropriate research methodologies in carrying out independent research in software engineering and produce a report demonstrating evidence of critical thinking.

Level 6 modules

Security and Forensics	Reasoning about Programs	Computer Science Project

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How will you be assessed?

As your learning continues it is important to stop every now and then and take stock of how much you learn so that you know where you are and how much more you still need to cover. In your course, assessment and feedback are the key elements in measuring learning. Assessment in your course has two functions: formative assessment is assessment that lets you see where you are in your learning and what you have learned so far, while summative assessment measures how much you have learned in a way that contributes to your overall grades.

You will undertake a **wide variety of assessment tasks** as you progress through your degree course. Their nature will vary according to your level and the nature of the task. Some, such as group work, will help you to develop practical skills alongside the more specific skills that are being assessed. It is particularly important for Software Engineering, where you can hardly find a piece of software used developed individually – on the contrary, in vast majority of cases software is produced by a team or even many teams each responsible for specific building blocks of the software, or modules, as we often call them. Much of software engineering responsibility is software management and documentation. Hence, you will learn and will be assessed in your writing skills, producing essays and research reports, and learn how to write in a style suitable to a piece of academic work, and to make proper use of references and bibliographies.

Other forms of assessment will include practical exercises ranging from small tasks that might be completed in a tutorial, to something more complex like designing and writing a larger computer program. There will be some formal examinations (usually at the end of each academic year). Some of the work will be completed individually, and sometimes you will work with other students as part of a team, emulating as close as possible the environment you will face in your later life in industry.

Many assessments will be based on real-life scenarios typically found in the software industry. This might include client requirement elicitation, extracting hard software requirements from given business requirements, then designing and implementing a solution.

All assessments that contribute to your final grades will be assessed against set criteria, following rigorous quality mechanisms that ensure our academic judgement remains fair and consistent with the wider educational sector. Typically, assessment tasks will become longer, and more self-managed, as you get into the second year and the final year of your course and they will have less detail in guidance and more room for you to innovate through your own decisions informed by your own research in your specialist areas. **Assessment is designed to be a learning experience in itself** and will help you make that transition from small practical exercises to more complex piece of work towards the substantial, year-long, project of your final year.

To help you see how different areas connect with each other you will have in some cases tasks that assess the outcomes from different modules in one complex piece of work. These are called **synoptic assessments**. Examples of synoptic assessment for your course include the Group Project at level 5 and the individual project at level 6.

Throughout your learning you will get feedback. **Feedback** will help you reflect on what you have learned so you can identify the areas in which you are strong and the areas in which you need to learn more. Feedback will be given to you in response to assessment, in response to questions in lectures, seminars and tutorials, and in guidance you will get during supervision. However, feedback will also come from your interactions with other students and with industry. All feedback will be useful to help you guide your learning so that you develop the rights skills faster.

Employment and further study opportunities

University of Westminster graduates will be able to demonstrate the following five Graduate Attributes:

- Critical and creative thinkers
- Literate and effective communicator
- Entrepreneurial
- Global in outlook and engaged in communities
- Social, ethically and environmentally aware

University of Westminster courses capitalise on the benefits that London as a global city and as a major creative, intellectual and technology hub has to offer for the learning environment and experience of our students.

The BEng Software Engineering course aims to create high quality graduates who have a strong focus on solving real-world problems, will have adaptability and maturity, and have a strong foundation of knowledge and the technical capability to be able to immediately contribute to their workplace environment. As a graduate of the BEng Software Engineering course you will have been taught and utilised industrial tools and techniques and will be versed in all aspects of the software lifecycle. As well as having a solid background in Software Engineering and computer science, you shall also have one or more specialisms that open up career pathways during their early years as a computing professional. You shall be independent thinker, lifelong learner and be able to analyse, critically reflect, and be able to confidently and effectively communicate. Graduating from this accredited course where professional skills and practice are embedded, graduates shall be able to meet the required professional and ethical standards expected in the modern software engineering workplace. Graduates shall also be capable and prepared for the broadening their knowledge by undertaking Masters level study or higher.

Note that specifically to software engineering, where software is currently produced by a team designing, implementing and maintaining sophisticated distributed applications, as our graduate you will find yourself working in such environment. The actual role within the team may be, for example, designer, programmer, systems administrator or systems analyst. Other types of roles possible are in computer science and software engineering research in a commercial company or academic institution.

There are emerging and very well-funded areas where software engineers may find their future career. These are, for examples, so called safety critical systems, such as traffic control systems, or medical diagnostics systems. On the other hand, there are emerging technologies related to big data computation and massive data storages, and software engineering roles mentioned above are one of the core roles in development and management of such complex modern very important for the society systems. There are

fields that would require very special software engineering skills and general computer science knowledge such as such as robotics and autonomous systems, where dedicated knowledge of modelling, algorithms and problem solving solutions, are in a growing demand.

Course structure

This section shows the core and option modules available as part of the course and their credit value. Full-time Undergraduate students study 120 credits per year. Course structures can be subject to change each academic year following feedback from a variety of sources.

The list below shows the core and option modules that are available as part of the course and their credit value. A *core* module is one that must be attempted to gain the award of BEng Software Engineering. Student choice is allowed for by designating a number of modules at levels 5 and 6 as subject-specific *options*. Students are free to choose modules from all the options (timetable dependant) and should seek advice from their personal tutor and other academics concerning their choice.

Some, but not all, of these modules will have to be taken to gain the award of BEng Software Engineering. The course specific regulations give full details of what must be taken and passed in order to gain an award.

BEng (Hons) Software Engineering– Core Modules

Credit Level 4 – Core				
Module code	**Module title**	**Status**	**UK credit**	**ECTS**
4COSC003W	Computer Science Practice	Core	20	10
4COSC004W	Computer Systems Fundamentals	Core	20	10
4COSC001W	Programming Principles I	Core	20	10
4MMCS003W	Web Design and Development	Core	20	10
4COSC002W	Mathematics for Computing	Core	20	10
4COSC005W	Programming Principles II	Core	20	10
Award of Certificate of Higher Education available				
Credit Level 5 - Core				
Module code	**Module title**	**Status**	**UK credit**	**ECTS**
5COSC001W	Object Oriented Programming	Core	20	10
5COSC004W	Client-Server Architecture	Core	20	10
5COSC003W	Software Development Group Project	Core	20	10
5COSC002W	Database Systems	Core	20	10
5SENG001W	Algorithms: Theory, Design and Implementation	Core	20	10
Award of Diploma of Higher Education available				
In addition the module Computer Science Placement is core for those undertaking the Industrial Placement year.				
Credit Level 6 – Core				
Module code	**Module title**	**Status**	**UK credit**	**ECTS**
6COSC006W	Final Year Project	Core	40	20
6SENG001W	Reasoning About Programs	Core	20	10
6COSC002W	Security and Forensics	Core	20	10

BEng Software Engineering option modules:

Credit Level 5 – Options				
Module code	**Module title**	**Status**	**UK credit**	**ECTS**
One of the following modules				
5CCGD002W	Applied Maths and Physics	Option	20	10
5CCGD003W	3D Graphics Programming	Option	20	10
5COSC005W	Mobile Application Development	Option	20	10
5COSC006W	Server-side Web Development	Option	20	10
Credit Level 6 – Options				
Two of the following modules				
6COSC005W	Advanced Server-side Web Programming	Option	20	10
6SENG002W	Concurrent Programming	Option	20	10
6CCGD002W	Advanced Maths and Game AI	Option	20	10
6COSC004W	Mobile Native Application Development	Option	20	10

Please note: Not all option modules will necessarily be offered in any one year.

Professional Body Accreditation or other external references

Reference points for the course

Internally
University Teaching and Learning policy statements,
University Quality Assurance Handbook and Modular Frameworks, staff research.

Externally
QAA Subject Benchmark statements,
Professional, Statutory, Regulatory Body requirements/guidance,
University and SEEC (credit consortium) level descriptors.

Professional body accreditation
British Computer Society (BCS) Criteria.

Academic regulations

The current Handbook of Academic Regulations is available at westminster.ac.uk/academic-regulations

How will you be supported in your studies?

Course Management

The BEng Software Engineering course is under the Computer Science Department (CS) and the management structure supporting the course is as follows:

- Dr Alexander Bolotov, Course Leader is responsible for day to day running and overall management of the course and development of the curriculum
- Dr Alexandra Psarrou, Head of Department, holds academic responsibility for the course and other courses within the Department
- Professor Jane Lewis, Dean of Faculty, holds overall responsibility for the course, and for the other courses run by the Faculty

Academic Support

Upon arrival, an induction programme will introduce you to the staff responsible for the course, the campus on which you will be studying, the Library and IT facilities, additional support available and to your Faculty Registry Office. You will be provided with the Course Handbook, which provides detailed information about the course. Each course has a course leader or Director of Studies. All students enrolled on a full-time course and part time students registered for more than 60 credits a year have a personal tutor, who provides advice and guidance on academic matters. The University uses a Virtual Learning Environment called Blackboard where students access their course materials, and can communicate and collaborate with staff and other students

Learning Support

The Academic Learning Development Centre supports students in developing the skills required for higher education. As well as online resources in Blackboard, students have the opportunity to attend Study Skills workshops and one to one appointments.

Learning support includes four libraries, each holding a collection of resources related to the subjects taught at that site. Students[1] can search the entire library collection online through the Library Search service to find and reserve printed books, and access electronic resources (databases, e-journals, e-books). Students can choose to study in the libraries, which have areas for silent and group study, desktop computers, laptops for loan, photocopying and printing services. They can also choose from several computer rooms at each campus where desktop computers are available with the general and specialist software that supports the courses taught at their Faculty. Students can also securely connect their own laptops and mobile devices to the University wireless network.

Support Services

The University of Westminster Student Affairs department provide advice and guidance on accommodation, financial and legal matters, personal counselling, health and disability issues, careers, specialist advice for international students and the chaplaincy providing multi-faith guidance. The University of Westminster Students' Union also provides a range of facilities to support students during their time at the University.

How do we ensure the quality of our courses and continuous improvement?

The course was initially approved by a University Validation Panel in *2009*. The panel included internal peers from the University, academic(s) from another university and a representative from industry. This helps to ensure the comparability of the course to those offered in other universities and the relevance to employers.

The course is also monitored each year by the Faculty to ensure it is running effectively and that issues which might affect the student experience have been appropriately addressed. Staff will consider evidence about the course, including the outcomes from Course Committees, evidence of student progression and achievement and the reports from external examiners, to evaluate the effectiveness of the course. Each Faculty puts in to place an action plan. This may for example include making changes on the way the module is taught, assessed or even how the course is structured in order to improve the course, in such cases an approval process is in place.

A Course review takes place periodically to ensure that the curriculum is up-to-date and that the skills gained on the course continue to be relevant to employers. Students meet with review panels to provide feedback on their experiences. Student feedback from previous years e.g. from Course Committees is also part of the evidence used to assess how the course has been running.

How do we act on student feedback?

Student feedback is important to the University and student views are taken seriously. Student feedback is gathered in a variety of ways.

- Through Course Committees students have the opportunity to express their voice in the running of their course. Student representatives are elected to Committee to expressly represent the views of their peer. The University and the Students' Union work together to provide a full induction to the role of the student representatives.
- Each Faculty also has its own Faculty Student Forum with student representatives; this enables wider discussions across the Faculty. Student representatives are also represented on key Faculty and university committees.
- All students are invited to complete a questionnaire before the end of each module. The feedback from this will inform the module leader on the effectiveness of the module and highlight areas that could be enhanced.
- The University also has an annual Student Experience Survey which seeks the opinions of students about their course and University experience. Final year Undergraduate students will be asked to complete the National Student Survey which helps to inform the national university league tables.

[1] Students enrolled at Collaborative partners may have differing access due to license agreements.