Anglia Ruskin University

Course Information Sheet

BSc (Hons) Software Development

Mode and course length – Full-Time (4 years)

Location – ARU Cambridge Campus

Awarding Body – Anglia Ruskin University. As a registered Higher Education provider Anglia Ruskin University is regulated by the Office for Students.

Overview

Use your coding and programming skills to lead the way in designing the future of software development projects. Think like a system developer while you gain knowledge in designing innovative business IT solutions, across various platforms, to deliver the techniques and tools employers demand.

Do you already have skills in coding and want to take your interest further? Industry is demanding coding and software development skills to meet business requirements and this course will help you understand what they are looking for and why.

We'll begin by focusing on these business requirements and principles of software to make sure you're thinking about how your skills will mould your career from day one.

You'll learn techniques for identifying, analysing and testing IT requirements of business scenarios and then develop the skills to design innovative IT solutions, using custom system analysis and design methods of scripting, programming, system analysis and design, and systems operation.

There's plenty of opportunity for practical work, as you carry out both individual and team tasks in the software development lifecycle, from analysis and design to implementation, testing and maintenance of a computer system, including database modelling, development and deployment.

You will develop essential skills in popular and versatile programming languages such as JavaScript, Java, PhP and .net supported by MySQL and SQLServer databases.

We're constantly looking for what's new in the industry, to stay ahead of the game. That's why you'll apply new models, techniques and tools for implementing custom designs of IT solutions, while you deliver high standard software products for various platforms.

Security standards and quality assurance benchmarks will run throughout everything you design, to ensure your software testing skills meet the ethical and professional standards demanded by the industry.

Course Delivery

Our courses are delivered through teaching and learning methods which provide students with the widest possible exposure to a modern and innovative higher education experience.

These methods vary and could include attendance at lectures and seminars, undertaking laboratory exercises or work-based activities, practical work, performances, presentations, field trips, other relevant visits and e-learning through Canvas, our online learning management system.

Each course is divided into a number of 'modules' which focus on particular areas, each of which has a specific approach to its delivery. This information is published to students for each module they take via the Module Definition Form (MDF) and Canvas.

Assessment

We'll use a range of assessment methods to help measure your progress. Besides exams, you'll undertake case studies, in-classes tests, coursework, group work, presentations and log books. There is a share of taught lectures and seminars versus independent study. Also, there is a good balance between coursework assessment and exam assessment.

Fees

Information about your course fee including any annual fee increases or deposits (if required) can be found in your offer letter.

Modules

Core Modules

Year 1: Foundation in Engineering, Computing and Technology

This module will provide students with the necessary skills to begin studying at level 4 in Engineering, Computer Science and related courses.

Students will be introduced to the core skills necessary to succeed in higher education, including thinking critically, researching and referencing appropriately, demonstrating appropriate numeracy and ICT skills, and communicating effectively verbally and in writing.

In addition to these fundamental skills, Students will cover the subjects underpinning the technological disciplines. Fundamental mathematical skills will be covered, alongside pre-calculus, followed by an introduction to calculus and vector and matrix arithmetic. Students will also be introduced to Classical mechanics, and its application to real-world scenarios. Students will be introduced to the fundamentals of computer science, learning about the principles behind programming and applying them through a series of practical coding exercises. Students will undertake a multi-disciplinary group project as they learn about the collaborative nature of engineering, and design from a broader perspective of business.

The module is made up of the following 8 constituent elements:

- Interactive Learning Skills and Communication (ILSC)
- Information Communication Technology (ICT)
- Critical Thinking
- Maths for Scientists
- Maths for Engineers
- Physics for Engineers
- Fundamentals of Computing
- Engineering Design

Year 2: Computer Modelling and Simulation

This module introduces the use of computer tools to solve engineering problems. It is intended to provide a sound understanding of the principles of generating a computer model, simulation or solution from a defined specification. The MATLAB software package is introduced, which allows mathematical expressions and algorithms to be implemented using various command functions and simple software statements. Basic ideas of producing plots are presented; relevant toolboxes are also discussed, e.g. the Statistics and Machine Learning Toolbox. Students are also introduced to the basics of Python language. Fundamental issues like variables, strings, tuples, loops, control flow, plotting, file input/output, functions will be discussed. Students will learn the basic features of NumPy (Numerical Python) and will create data visualisations with Matplotlib. This module will also introduce the Pandas library for data analysis. Finally, students will learn how to solve problems by incorporating all the elements reviewed in the module and apply them in different scenarios. The emphasis in learning computer languages will be on a structured approach. The applications targeted will be in the area of modelling and solving technological problems relevant to students' course.

Year 2: Learning and Skills Development for HE and Work

Students entering Higher Education will need specific study skills to enable them to maximise their learning potential and take advantage of opportunities available both in the academic setting and the workplace. Students will enter with different levels of skills and experience and may approach the module in a variety of ways. The module is intended to be both preparatory and

supportive building a strong foundation for learning and later development. The module delivery will be organised to develop and underpin Level One study skills in the first half of the trimester with the focus moving towards individual formative support towards the end of the trimester. Students will develop and maintain a reflective learning log/blog to support this module and their continuing studies, the reflective log/blog to be used as the basis of tutorial work and formative assessment. Students will be expected to meet with their personal tutors to review their progress and actively seek out a mentor within the university community or workplace.

Year 2: Software Principles

This module introduces the fundamental concepts required to understand, design, implement and test high-level programming languages, Students will be introduced to a design methodology to help develop linear and hierarchical trains of thought from idea conception through design and implementation to testing. Using a simple interactive programming environment, students will discover how to create and use a wide variety of different basic and complex data structures. By the end of the module, students will be expected to be able to: Analyse a simple set of requirements; design appropriate data structures; select appropriate language syntax to manipulate program data; understand and use syntax for the implementation of conditional logic and repetition; be able to create simple scripts to perform a number of operations in turn to achieve a desired effect; demonstrate familiarity with the taxonomy of programming languages and the software development life- cycle; gain sufficient experience of a range of algorithm design techniques, such that, given a simple problem description, appropriate variables, decisions and repetitive actions can be identified and translated into appropriate code constructs.

Year 2: Networked Systems

This module introduces students to the components and requirements of modern networked computer systems. In order to understand how such systems work it is necessary to consider the operating system, through the networking technology to the servers to be accessed. On completing this module, students will be able to specify, construct and maintain networked PC systems, and troubleshoot common hardware and software problems. Practical skills are underpinned by a sound theoretical foundation in computer systems and network architecture, including both local area networks (LANs) and wide area networks (WANs). Theoretical topics will be delivered in weekly lectures that will be consolidated through significant self-study. Laboratory sessions will enable students to gain the practical skills needed to construct, maintain and troubleshoot problems on networked computer systems.

Year 2: Core Mathematics for Computing

This module will equip students embarking on a degree in Computer Science with the core mathematical skills necessary to succeed. The module will begin by refreshing students' arithmetic and algebra skills, including basic notation, variables and constants, number types (real and natural numbers, integers, irrational/rational numbers, and so on), ratios, percentages and fractions, bases, exponents, roots/surds, order of operations, product and summation notation, factorising, rationalising, scientific form, decimal places and significant figures, floors/ceilings, rounding, modular arithmetic, the interpretation and manipulation of algebraic expressions, simultaneous and quadratic equations and scientific calculator use. Probability and statistic analysis methods will be introduced, including histograms, uniform and Gaussian distributions, accuracy and precision, descriptive measures of central tendency and dispersion, correlation, and basic (parametric) inferential techniques for hypothesis testing. Good practice in data plotting will be emphasized, including axis labelling and scaling, error bars, and the placement of dependent/independent variables, which will be strengthened by laboratory exercises using a graphing-capable software package, such as MATLAB. Basic notation in set theory and discrete mathematics will be introduced, along with number bases, permutations, combinations and combinatorial logic, including truth tables, which will be related to conditional logic statements in computing. Exponential, logarithmic, and linear functions will be discussed in detail; limits and the generation of recursive/non-recursive sequences and series will be related to the computational growth of elementary algorithms involving simple computational structures. Throughout the module, wherever possible, theory will be explicitly related to computer science topics, and general reusable skills will be favoured over more esoteric topics. Weekly classroom exercises will completed to reinforce learning and give the student the opportunity to work through (and receive formative feedback on) many example problems prior to summative assessment.

Year 2: Operating Systems

This module will introduce students to the fundamental features of modern operating systems, their components and their use. It will look at key concepts including the kernel and its modes; memory and resource management; file systems, security and

authentication; single and multi-tasking; interrupts, hardware and device drivers and command line and graphical user interfaces (GUI). The module will also introduce students to the command line interface (CLI) commands and scripting in both the Windows CLI and a Linux shell and allow them to develop simple scripts to automate activities in both operating system environments. It will also explain how each operating system stores configuration information and how (particularly in Linux/Unix) scripts can be used to modify the system configuration. No specific knowledge is needed before undertaking the module, however a basic user level familiarity with a GUI based operating system (such as Windows) will be useful. The skills acquired in the module will enable students to go on to study modules which involve topics such as system administration, network and server configuration and technical support all of which are key skills graduates need when working in the systems and network support industries.

Year 3: Object and Data Modelling

This module aims to cover two important areas of computer systems design in great depth based on the fundamentals of design introduced in Design Principles. The first area is the analysis and design of computer software using Object-oriented methodology. Starting with the basic concepts of object-oriented analysis and design methodology a range of Unified Modelling Language (UML) methods and techniques will be introduced, independent of any specific programming languages. Students are required to learn about the theories of Object-oriented methodology and its modelling methods and techniques. What is more important is that students will also learn to develop the ability and skills in applying object modelling methods to carry out practical system analysis and design tasks based on a given case study. This part of the module will also appreciate the strengths of object oriented analysis and design methodology in comparison with other methodologies, particularly the structured system analysis and design methodology and examine the stages of object oriented development lifecycle and corresponding methods used for each stage. Through the module, students will familiarise with notations of the latest version of UML and apply them in the practical work of analysing and designing a computer system. The second part of this module covers a wide range of issues with regard to analysis, design and implementation of relational databases using one of the industrial standard relational DBMS. Data capturing and modelling techniques such as Entity Relationship Diagramming and Normalisation will be introduced. Students will also learn how to design and construct queries using Structured Query Language (SQL) and apply them to extract useful information from relational databases. Provided resources for this module include UML diagramming and data modelling software, lecture notes, and tutorial materials for practical sessions. Online facilities such as SharePoint LMS will be used to assist the delivery of this module.

Year 3: Cloud Development

From an examination of some of the more successful commercial web sites, it is evident that an appreciation of multi-sensorial web design is central to the production of a truly engaging site. Whilst modern development packages may contain all the essential tools needed to achieve this, without sufficient understanding of the principles of digital design, a web site is unlikely either to impress or deliver. This module is intended for students involved in the high-level design processes of interactive web sites. It includes a thorough grounding in the principles and practice of digital visual design using current coding and scripting methods as the delivery technology. Students work to a specific brief interpreting and analysing the original context to shape and inform the design, implementation and production of a web-based multimedia object. Using a suite of commercial-standard development tools and technologies students apply appropriate theory to the design, specification and creation of a visually cohesive multimedia site designed to meet the student's specific design criteria. The module includes: individual research for selected topics e.g. marketing, site planning and structure, digital layouts, creating design style, navigation models and methods, and metaphors for web sites. Students will apply key design concepts, principles and elements of visual design to web sites, multimedia components and static images to an acceptable commercial standard. The delivery of the module will include mix of e-learning and resources, lab instruction and demonstration, lectures, internet research, and several topic workshops. Specialist resources required are the current version of Adobe Creative Suite or equivalent, MAMP or equivalent and internet / FTP access and access to the safari online text (Badre A (2002) Shaping Web Usability - Interaction Design in Context Addison-Wesley).

Year 3: Data Security

Information technology has created a world that is increasingly virtual in nature. Both private individuals and businesses alike suffer the same vulnerabilities in managing access to valuable information that is increasingly being stored remotely. Whilst the public and industry professionals wrestle with the escalating complexity and variation in the ways that information is compromised, we see the emergence of the harnessing of digital insecurities as a weapon on an international stage. This module introduces some of the key concepts that lie at the heart of information security, but viewed at the more fundamental data level. It provides a critical insight into the often misunderstood or poorly defined issues of data security and thereby offers the student a springboard to the study of information security at level 6. After studying this module the student will understand how

and why the digital data systems we use everyday pose such a threat to individuals and businesses, where solutions are possible and where they might prove difficult or impossible. A key issue will be the fundamental weakness that humans introduce into the technology. Students are expected to augment the content delivered by lectures with independent study of their own on a weekly (or even daily basis) in order to remain current with developing threats.

Year 3: Object Oriented Programming

This module develops the programming skills learnt in the earlier level to enhance the knowledge and skills of students in the object-oriented programming paradigm.

The essential aspects of input/output routines, control structures, contiguous data structures, and the devolvement of Objects and Methods are covered in sufficient detail to ensure a good coverage of the Object-Oriented paradigm. During the module students will be trained to adopt the computational way of thinking that a software developer is expected to possess. By the end of the module, students will be expected to be able to assemble multiclass programs that meet the business requirements set in a specification.

Apart from exploiting the chosen programming language's basic capabilities, mechanisms for associating classes are to be considered in detail. Best programming practice will be taught and used to ensure a maximum level of productivity and quality. In addition, methods and techniques will be introduced and applied to the validation and verification of software quality and standards.

Year 3: Design Methods and Technology Project

This module is essentially a mini project where students undertake to design some artefact, eg: electronic hardware, software, multimedia production, website etc. The management of the project is in itself a core element and students are expected to produce a formal specification using sound design methods, a time plan and progress indicator. Students will also be expected to produce a number of alternative designs that meet the specification, select the most appropriate design using recognised techniques and carry out design reviews. Students have a free hand at choosing the subject of the project, but close supervision is provided in order to limit over-ambition or to raise the level as appropriate. The lecturer acts as Project Supervisor and assessor as well as a mentoring resource throughout the execution of the project. Students have access to the full resources of the university and may use any laboratory facilities by arrangement with the relevant Lab Technician. At the early stage of the module, guidance is given about design methods and project planning, then students will work independently and may use the lecturer as a resource and mentor if they so wish.

Year 3: Project Management and Quality Assurance

Any graduate working in the IT field will find themselves part of a project team. For projects to proceed successfully it is important for all members of the team to be aware of their roles and responsibilities. It is therefore essential that graduates should have knowledge of the structure of IT projects, the tools and techniques used for planning, monitoring and controlling such projects, and their role as a member of such a team. This module will introduce students to the tools and techniques commonly used in IT based projects. Students will be given the opportunity to practice with the tools to enhance their understanding and competence. At every stage within any artefact development it is necessary to ensure correct quality monitoring and control procedures are in place. The quality assurance portion of this module helps the student to develop an understanding of the range of techniques which can be used to promote quality and their cost/benefit issues. A range of verification and validation procedures will be presented and practiced. Students will be introduced to the standards relevant to IT projects and the relevant accreditation procedures discussed. The learning in this module is mainly through taught sessions with practical and theoretical tutorial sessions involving formative exercises. The specialist resource required is a computer based project management tool such as MS Project

Year 4: Final Project

The individual Final Project module allows students to engage in a substantial piece of individual research and / or product development work, focused on a topic relevant to their specific discipline. The topic may be drawn from a variety of sources including: Anglia Ruskin research groups, previous / current work experience, the company in which they are currently employed, an Anglia Ruskin lecturer suggested topic or a professional subject of their specific interest (if suitable supervision is available). The project topic will be assessed for suitability to ensure sufficient academic challenge and satisfactory supervision by an academic member of staff. The chosen topic will require the student to identify / formulate problems and issues, conduct

literature reviews, evaluate information, investigate and adopt suitable development methodolgies, determine solutions, develop hardware, software and/or media artefacts as appropriate, process data, critically appraise and present their finding using a variety of media. Regular meetings with the project supervisor should take place, so that the project is closely monitored and steered in the right direction. The project developed in this module is the most substantial piece of work that the student is producing during their undergraduate studies. Thus, the choice of project topic and the quality of the work is likely to bear a great influence on the student's career / employability. Therefore, the module will also include aspects of Personal Development Plan and CV preparation. The students are strongly advised to allocate appropriate attention, time and effort to this module. The successful completion of the module will increase students' employability, as they will acquire skills directly applicable to real world projects.

Year 4: Advanced Object Oriented Programming

With the foundation knowledge and basic/intermediary level of Java programming skills that students have learned from the Object Oriented Programming module at Level 5, the module offers to develop students' understanding of more advanced concepts of object oriented programming and become a better programmer with a higher level of skills and competence. The module will introduce advanced capabilities of an object-oriented language as well as its versatile functionalities used to develop a range of software products.

In this module students will learn to develop efficient algorithms using complex data structures, concurrent programing skills and component-based software development using an integrated development environment (IDE).

Good programming practice will be reinforced throughout the module. Software testing and validation methods will be used to measure the quality and standards of software products.

Year 4: Ethical Computing

With computer systems becoming even more essential components in our lives and software controlling virtually all aspects of our environment it is important that the people developing these systems behave in an ethical and trust worthy manner. This can also apply to the way social media is used as a means of communication. It is vital that all software developers are aware of their legal and ethical responsibilities so that they operate in a professional manner and are a credit to the profession.

This module aims to ensure that graduates are aware of the legal framework in which they work and the ethical issues that may occur with the systems they develop. The role of professional bodies in this context will be discussed. Ethical and legal questions will be raised and discussed to ensure that a critical approach to the topic is developed. The increase use of cloud computing, big data and social media provide many opportunities for situations where enterprise opportunities rise ethical and legal questions.

The ethical question is broadened to include sustainability issues. The module will put the student in the global perspective to demonstrate how they can be a 'good citizen' and ensure proper ethical design, build and destruction of systems.

Students will be required to research a topic, discuss the ethical, legal and sustainability aspects, present their findings to the class and submit a report.

Year 4: Application Development

With increasing effective network bandwidth the data-server model has re-emerged as a desirable strategy for implementing data-driven business applications. With the deployment of Virtual Private Networks in many sectors of commerce, for example in point-of-sale service businesses such as travel agents, estate agents and other similar retail outlets, the need for a centralized database model with a simple client interface has emerged. The thin client model allows for the development of a simple interface application with little or no local functionality, user requirements being centred on server-based processing. This module will equip students with a theoretical appreciation of developing thin-client/fat-server applications backed up by strong practical experience with state-of-the-art software. Including deployment via a web or mobile interface. Emphasis will be on a practical approach with half the scheduled class time devoted to active programming. Students will be expected to design, implement and deliver a robust, multi-user, client-server web / mobile application based on a real-world specification. The intention is to give students the experience of developing a complete solution to a business requirement and thereby develop a range of skills that goes beyond just the technical knowledge needed to write program code. Importantly in this module, it is possible for students to develop and test their web / mobile applications locally on one machine (including personally owned

laptops) thereby greatly simplifying the progress and development of assignment work.

Year 4: Database-driven Application Programming

This module will give students the theoretical knowledge and the practical skills to design and program data-driven applications. Students will benefit from exposure to a program design methodology that will make the design and implementation of robust and professional applications easier and quicker whilst at the same time generating program documentation for future updating and maintenance purposes. There will be substantial support provided for students through face-to-face sessions as well as materials via LMS web site. The module and its assessment represent both an intellectual and practical challenge to produce a complete database-driven solution to a business requirement with the opportunity for the student to extend the scope of the application. As such, this module provides the student with the opportunity to develop confidence in front-end application programming as well as learning skills in setting up, tuning and programming the back-end database management systems.