UNIVERSITY OF LIVERPOOL

Computer Science and Electronic Engineering with Year in Industry BEng (Hons)

COURSE DETAILS

- A level requirements: ABB
- UCAS code: HG6L
- Study mode: Full-time
- Length: 4 years

KEY DATES

- Apply by: 31 January 2024
- Starts: 23 September 2024

Course overview

Smart devices shape the way we live, both now and in the future. Study Computer Science and Electronic Engineering at Liverpool and ensure you're a part of the rapid technological development taking place globally.

INTRODUCTION

This programme combines the core elements of electronic engineering with those of computer science, which is the intellectual discipline underlying all aspects of software development.

Combining elements from these two disciplines will equip you with an added breadth of knowledge and greater specialisation. Our graduates are in demand because of their fluency both in the language of electronic engineers, as well as that of computer scientists, enabling you to bridge the gap between software systems and the real world.

You'll be taught by staff who are actively engaged in research, most with international reputations, ensuring you'll receive the most up-to-date and commercially-relevant education.

Take your university experience even further on a paid year-long industry placement, or spend a year abroad at a partner university or our China campus.

WHAT YOU'LL LEARN

- A broad educational background in electronics and computing
- Critical thinking
- Teamwork

- The practical application of concepts and theory, always with awareness of their relevance to the real world
- How to take projects from conception, through to design, implementation and operation
- Use of industry standard tools, technologies and working methods
- Practical engineering experience

ACCREDITATION

Accredited by the Institute of Engineering and Technology (IET)

Course content

Discover what you'll learn, what you'll study, and how you'll be taught and assessed.

YEAR ONE

During year one you will be introduced to the fundamentals of electronics as well as the underlying principles and theory of computing. Your lecture modules will cover the core subjects of electronic circuits, digital electronics, Java programming and data structures.

In addition, you will take modules such as mathematics and spend one day a week doing practical work in both the computer and electronics laboratories. This will give you excellent practical and transferable skills vital for subsequent years of the programme and invaluable in your future career.

COMPULSORY MODULES

ELECTRICAL CIRCUITS & SYSTEMS (ELEC142)

Credits: 15 / Semester: whole session

Fundamental course on circuit analysis techniques.

DIGITAL & INTEGRATED ELECTRONICS DESIGN (ELEC143)

Credits: 15 / Semester: semester 2

The module comprises of two parts Digital Electronics and Integrated Electronics. For the Digital part, students are provided with the knowledge of number systems, laws of Boolean algebra and introduced to the basic methods for designing combinational and sequential logic circuits. For the Integrated part, students are introduced to various silicon electronic devices and provided with the opportunity to understand the basic principles of silicon microelectronics designs processes including designing layouts for simple circuit.

ELECTRONIC CIRCUITS (ELEC104)

Credits: 15 / Semester: whole session

This module aims to introduce students to fundamental electronic devices (diodes and transistors), and how these devices are used in amplifier and switching circuits. The module is assessed via two laboratory sessions (20%) and two coursework online assignments (80%).

ENGINEERING SKILLS (ELEC171)

Credits: 15 / Semester: whole session

Introductory module that teaches practical skills for electrical engineering students, focusing on basic laboratory skills. The practical skills are linked with theory presented in other Year 1 modules including those on analogue and digital electronics, and electromagnetics. The

modules including those on analogue and digital electronics, and electromagnetics. The module includes an introduction to a technical programming language (MATLAB) and an introduction to the ethical and sustainability issues that face modern engineers.

OBJECT-ORIENTED PROGRAMMING (COMP122)

Credits: 15 / Semester: semester 2

The intention of COMP122 is to introduce students to the concepts and methodology of object-oriented programming using the Java programming language. Topics covered include hierarchical structures, polymorphism, collections and iterators, exception handling, and graphical user interface design. Basic concepts of software design methodology, testing, and version control are also included in the module. It is normally expected that students have prior programming experience.

MATHEMATICS A FOR ELECTRICAL ENGINEERS (ELEC191)

Credits: 15 / Semester: semester 1

Mathematics for students registered in the Department of Electrical Engineering and Electronics, to support their technical modules.

MATHEMATICS B FOR ELECTRICAL ENGINEERS (ELEC192)

Credits: 15 / Semester: semester 2

Basic mathematics for students registered in the Department of Electrical Engineering and Electronics, concentrating on those groups of students who have, on the average, weaker preparation for University level Maths such as entrants with the BTEC qualification (but not limited to that group). Exam practice is another important component of this module. This module follows on from ELEC191

OPTIONAL MODULES

INTRODUCTION TO PROGRAMMING (COMP101)

Credits: 15 / Semester: semester 1

The module provides an introduction to procedural programming using current language platforms. The module incorporates program design, problem solving, the importance of maintainable, robust software and testing as well as introducing procedural language main programming constructs. Students gain practical experience with program design, programming and testing during weekly laboratory sessions.

PROGRAMMING LANGUAGE PARADIGMS (COMP105)

Credits: 15 / Semester: semester 1

This module is for students that already have some programming skills. Students will learn about the two main programming paradigms: imperative programming and functional programming. Since most introductory programming courses teach imperative

programming, this module will focus on the functional paradigm. Students will learn how to program in Haskell, a popular functional programming language. They will learn how to formulate programs in a functional way, and the common techniques and idioms that are used to solve problems in functional programming.

Programme details and modules listed are illustrative only and subject to change.

YEAR TWO

The second year builds on the first with core modules in software engineering, database development, digital electronics, and signals and communication systems. More time is spent in the electronics laboratory doing practical work to consolidate the knowledge learnt in lectures and partaking in an extended team project.

COMPULSORY MODULES

COMMUNICATION SYSTEMS (ELEC202)

Credits: 7.5 / Semester: semester 2

This module will teach fundamental knowledge on communication systems.

DATABASE DEVELOPMENT (COMP207)

Credits: 15 / Semester: semester 1

This module introduces students to the problems arising from databases, including concurrency in databases, information security considerations and how they are solved; the integration of heterogeneous sources of information and the use of semi-structured data; non-relational databases and the economic factors involved in their selection and to techniques for analysing large amounts of data, the security issues and commercial factors involved with them.

DIGITAL ELECTRONICS & MICROPROCESSOR SYSTEMS (ELEC211)

Credits: 15 / Semester: semester 2

This module covers two areas. In digital electronics, it covers topics which build on the basic knowledge gained in the first year digital electronics programme and learning some hardware description language (HDL) programming. In microprocessor systems, it introduces the topic from the basics describing how a microprocessor works and learning some assembly language programming.

ELECTRONIC CIRCUITS AND SYSTEMS (ELEC271)

Credits: 15 / Semester: semester 2

The module concerns the understanding of how electronic amplifier circuits work and some basic ideas on how to design them. This requires an appreciation of linear small-signal

basic ideas on how to design them. This requires an appreciation of linear small-signal equivalent circuits based on device physics and how to use them to assist the design process. Students will also learn how to break down complex circuits into simpler building blocks and how these blocks in turn, represented by linear equivalent circuits, can be combined to achieve the desired functionality. How negative feedback can be applied to produce high performance, stable circuits with high tolerance. The current state of the art is emphasised together with a historical perspective, noting some of the pioneers in the field.

INSTRUMENTATION & CONTROL (ELEC207)

Credits: 15 / Semester: whole session

This module covers the design and operation of instrumentation devices as well as the design of continuous time control systems.

PROJECT, PROBLEM SOLVING & INDUSTRIAL AWARENESS (ELEC222)

Credits: 7.5 / Semester: whole session

The aim of this module is to provide students with practical work which underpins, confirms and gives application focus for academic study, while testing a wide range of skills.

SIGNALS AND SYSTEMS (ELEC270)

Credits: 15 / Semester: semester 1

Introduces continuous and discrete signal operations and analysis, the frequency domain and spectral analysis, including Fourier Series and Fourier, Laplace and z Transforms. Introduces system quantification and analysis, including pole-zero plots, feedback, basic stability criteria and block diagrams.

SOFTWARE ENGINEERING I (COMP201)

Credits: 15 / Semester: semester 1

This module deals with the issues associated with the analysis, design, implementation and testing of significant computing systems (that is, systems that are too large to be designed and developed by a single person).

DISTRIBUTED SYSTEMS (COMP212)

Credits: 15 / Semester: semester 2

This module covers the concepts of distributed systems and the underlying principles of distributed computing and discusses the issues and various solutions proposed in the distributed computing community. Specifically, communication and broadcast, election algorithms, synchronization and concurrency, fault-tolerance and security related issues will be discussed in the lectures. Where applicable practical implementations of the concepts will be introduced.

Programme details and modules listed are illustrative only and subject to change.

YEAR THREE

This is the placement year, during which you will spend time working in an engineering company. The placement is assessed by two reports, a poster and an oral presentation.

Preparation for the placement is provided by the University's Careers and Employability service, who will assist in finding a placement, creating a professional-looking CV and preparing you for interview. Placements can be local, located nationally within the UK, or even take place abroad in the likes of Europe and China.

COMPULSORY MODULES

UG PLACEMENT IN YEAR3 (ELEC299)

Credits: 120 / Semester: whole session

This module is for the students in the year in industry.

Programme details and modules listed are illustrative only and subject to change.

YEAR FOUR

You will undertake an extended individual project during this year. Recent projects have included real-time GPS tracking of a vehicle fleet by mobile phones, and mobile multi-user dungeon (MUD) game using SMS messaging. You can choose lecture-based modules from both Electronic Engineering and Computer Science.

COMPULSORY MODULES

APPLICATION DEVELOPMENT WITH C++ (ELEC362)
Credits: 15 / Semester: semester 1

This course will help student to understand the object-oriented design concept and to gain knowledge and practical skills of C++ as an advanced programming language.

On successful completion of the module, students should be able to understand/design/develop C++ applications (both console and GUI-based) with a specific emphasis on developing GUI-based applications.

EMBEDDED COMPUTER SYSTEMS (ELEC370)

Credits: 15 / Semester: semester 1

In this module students gain an understanding of the construction and operation of embedded computer systems and their components. Furthermore they gain an understanding of how computer performance is dependent upon the design of computer

understanding of how computer performance is dependent upon the design of computer architectures and sub-circuits.

NEURAL NETWORKS (ELEC320)

Credits: 7.5 / Semester: semester 2

Introduction to neural network theory, applications and artificial intelligence.

ENGINEERING MANAGEMENT & ENTREPRENEURIAL SKILLS (ELEC352)

Credits: 7.5 / Semester: semester 1

This module covers project management for year 3 students registered in the Department of Electrical Engineering and Electronics. Entrepreneurial skills are also be covered.

OPTIONAL MODULES

ADVANCED MODERN MANAGEMENT (MNGT352)

Credits: 7.5 / Semester: semester 1

The Aims of this module are as follows:

To introduce the student to various aspects of advanced modern management.

To develop a knowledge and understanding of modern management tools.

To stimulate an appreciation of management and its importance in organisational success.

DIGITAL CONTROL AND OPTIMISATION (ELEC303)

Credits: 15 / Semester: semester 2

A broad range of topics are covered. Case studies and example tutorials emphasise the practical aspects of digital control design and optimisation.

FORMAL METHODS (COMP313)

Credits: 15 / Semester: semester 2

As more complex computational systems are used within critical applications, it is becoming essential that these systems are formally specified. Such specifications are used to give a precise and unambiguous description of the required system. In addition, as computational systems become more complex in general, formal specification can allow us to define the key characteristics of systems in a clear way and so help the development process. Formal specifications provide the basis for verification of properties of systems. While there are a number of ways in which this can be achieved, the model-checking approach is a practical and popular way to verify the temporal properties of finite-state systems. Indeed, such temporal verification is widely used within the design of critical parts of integrated circuits, has recently been used to verify parts of the control mechanism for one of NASA's space probes, and is now beginning to be used to verify general Java programs.

This module will introduce: the principles of standard formal methods, such as Z; the basic

notions of temporal logic and its use in relation to reactive systems; the use of model checking techniques in the verification of reactive systems.

INTRODUCTION TO COMPUTATIONAL GAME THEORY (COMP323)

Credits: 15 / Semester: semester 1

This module is an introduction to the area of algorithmic game theory, which is a novel area in the intersection of economics and computer science. It provides tools for dealing with and analysing problems related to applications motivated by the Internet. Examples involve various Internet auctions and e-commerce systems, like, Google's sponsored search, Ebay auctions, recommendation systems, etc.

MULTI-AGENT SYSTEMS (COMP310)

Credits: 15 / Semester: semester 2

Multi-agent systems have emerged as one of the most important areas of research and development in information technology in the 1990s. A multi-agent system is one composed of multiple interacting software components known as agents, which are typically capable of co-operating to solve problems that are beyond the abilities of any individual member. Multi-agent systems are important primarily because they have been found to have very wide applicability, in areas as diverse as industrial process control and electronic commerce. This module will begin by introducing the student to the notion of an agent, and will lead them to an understanding of what an agent is, how they can be constructed, and how agents can be made to co-operate effectively with one another to solve problems.

PHOTONICS AND OPTICAL INFORMATION SYSTEMS (ELEC313)

Credits: 15 / Semester: semester 1

The aims of this module are: To introduce students to the fundamental principles of opto/electronic systems for the transfer of information. To introduce the duality of light as both wave and ray. To show intensity and phase related optical principles. To demonstrate optical information transfer through a number of applications.

SIGNAL PROCESSING AND DIGITAL FILTERING (ELEC309)

Credits: 15 / Semester: semester 2

This module is aimed at developing the basic framework for signal processing and to demonstrate its applications. Also, the module provides students with a good understanding of the types, behaviours and design of FIR and IIR digital filters.

Teaching and learning are provided through a variety of means like formal lectures, problem sheets, supplementary questions, along with formative and summative online tests (through CANVAS, the electronic VLE system).

Assessment is carried out by means of two assignments and final (written) exam.

BIOCOMPUTATION (COMP305)

Credits: 15 / Semester: semester 1

Biology inspired adaptive algorithms such as Artificial Neural Networks (ANNs) and Genetic Algorithms (GAs) play an important role in modern computing, information processing, and machine learning. The latest increase in computer power ensured broad use of the algorithms to solve problems in science and engineering previously considered impossible to tackle. ANNs are now broadly used in pattern recognition, including speech recognition and classification problems, statistics, functional analysis, modelling financial series with considerable stochasticity, etc. GAs are search procedures based on the mechanics of natural selection and natural genetics. They provide effective solutions to a variety of optimisation problems in economics, linguistics, engineering, and computer science. Both ANNs and GAs can exploit massively parallel architectures to speed up problem solving and provide further understanding of intelligence and adaptation.The main goals of the module are to introduce students to some of the established work in the field of Artificial Neural Networks and Genetic Algorithms and their applications, particularly in relation to multidisciplinary research. To equip students with a broad overview of the field, placing it in a historical and scientific context. The module provides students with the knowledge and skills necessary to keep up-to-date in actively developing areas of science and technology and be able to make reasoned decisions.

PLASMA SYSTEM ENGINEERING (ELEC391)

Credits: 7.5 / Semester: semester 1

The module introduces to the students the basic concepts of electrical plasmas and how they are used in industry. It concentrates on the engineering principles behind plasma technology rather than the physics of the discharge, however some mathematical approaches are explored so that quantification of the action of plasmas upon material surfaces can be made. The module explains how a gas can turn into a plasma and how high energy ions in the plasma can be generated to process a substrate, such as silicon wafer in micro-electronics fabrication. The module is taught by a mixture of power points notes and chalk and talk. There are a number of question sheets given out to help the students understand the basis plasma-material processes. On completion, students will understand how plasmas are used in industry, they will have an appreciation of some aspects of simple design and how plasmas can be configured for the next generation of fusion power stations.

DIGITAL SYSTEM DESIGN (ELEC373)

Credits: 15 / Semester: whole session

This module introduces students to the digital design techniques used in industry and research. The methods for describing digital systems using the Verilog Hardware Description Language (HDL) are introduced. Student will examine the operation of the MIPS Processor and will also be introduced to Altera's NIOS-II Processor. The module is assessed via 4 assignments and two class tests. Altera's Quartus package is used for synthesising the digital systems.

HONOURS YEAR COMPUTER SCIENCE PROJECT (COMP390)

Credits: 30 / Semester: whole session

The honours year project gives students the opportunity to study independently on an extended piece of work under the guidance of an academic supervisor. Many diverse projects are available for selection, inspired by the research of the department. Each student is encouraged to propose a project in an area that meets their own personal needs, whether it's related to their career aspirations or simply an interesting academic pursuit. The project consolidates learning from the taught part of the course, with authentic assessment that is designed to encourage communication of complex ideas via a range of media. On completion of the module, students will have the confidence to pursue their career, having developed proficiency in their chosen topic and an ability to communicate clearly and effectively.

BENG PROJECT (ELEC340)

Credits: 30 / Semester: whole session

Students undertake an extended individual project. Projects are specified by academic staff and cover the whole range of Electrical and Electronic Engineering including hardware (both analogue and digital), software and simulation or a mixture of these. Students can also suggest their own projects which need to be approved by an academic supervisor. Students work closely with their academic supervisor to realize their project aims and assessment is split between a preliminary report, an oral presentation, the bench inspection and the final report.

SOFTWARE ENGINEERING II (COMP319)

Credits: 15 / Semester: semester 1

The overall aim of this module is to introduce students to a range of advanced, near-research level topics in contemporary software engineering. The actual choice of topics will depend upon the interests of the lecturer and the topics current in the software engineering research literature at that time. The course will introduce issues from a problem (user-driven) perspective and a technology-driven perspective where users have new categories of software problems that they need to be solved, and where technology producers create technologies that present new opportunities for software products. It will be expected that students will read articles in the software engineering research literature, and will discuss these articles in a seminar-style forum.

Programme details and modules listed are illustrative only and subject to change.

HOW YOU'LL LEARN

Programmes are taught over two semesters, with examinations at the end of each semester. Modules vary from those which are assessed by examination only, to others which are continuous assessment only. All programmes incorporate a substantial practical component, with an increasing emphasis on project work as you progress through to the final year.

HOW YOU'RE ASSESSED

Assessment on this course will include a mix of exams, coursework and projects.

LIVERPOOL HALLMARKS

We have a distinctive approach to education, the Liverpool Curriculum Framework, which focuses on research-connected teaching, active learning, and authentic assessment to ensure our students graduate as digitally fluent and confident global citizens.

Careers and employability

Some of our graduates go on to work in the industrial sector, in government and in education, whilst others enter non-technical professions such as banking, accountancy, management and law.

Specific career paths are many and varied, and have previously included Design Engineer, Systems Engineer, Medical Physicist, Postdoctoral Research Scientist and Radio Frequency Scientist.

100% **OF ELECTRICAL ENGINEERING AND ELECTRONICS STUDENTS ARE IN WORK AND/OR FURTHER STUDY 15 MONTHS AFTER GRADUATION.**

Discover Uni, 2018-19.

Many graduates have moved on to have careers with employers such as:

- ARM Holdings Ltd
- British Nuclear Group
- Deva Electronic Controls
- Energetix Group PLC
- Ericsson Ltd
- Heap and Partners Ltd
- Logica CMG
- Marconi
- Ministry of Defence
- Royal Liverpool University Hospital (Clinical Engineering)
- Science and Technology Facilities Council
- Daresbury Laboratory
- Scottish Power
- The Highways Agency
- United Utilities PLC
- Siemens UK

PREPARING YOU FOR FUTURE SUCCESS

At Liverpool, our goal is to support you to build your intellectual, social, and cultural capital so that you graduate as a socially-conscious global citizen who is prepared for future success. We achieve this by:

- Embedding employability within your curriculum, through the modules you take and the opportunities to gain real-world experience offered by many of our courses.
- Providing you with opportunities to gain experience and develop connections with people and organisations, including student and graduate employers as well as our global alumni.
- Providing you with the latest tools and skills to thrive in a competitive world, including access to Handshake, a platform which allows you to create your personalised job shortlist and apply with ease.
- Supporting you through our peer-to-peer led Careers Studio, where our career coaches provide you with tailored advice and support.

Fees and funding

Your tuition fees, funding your studies, and other costs to consider.

TUITION FEES

UK fees (applies to Channel Islands, Isle of Man and Republic of Ireland)	
Full-time place, per year	£9,250
Year in industry fee	£1,850
Year abroad fee	£1,385

International fees	
Full-time place, per year	£25,750
Year in industry fee	£1,850
Year abroad fee	£12,875

*Fees stated are for the **2023-24** academic year and may rise for 2024-25.*
Tuition fees cover the cost of your teaching and assessment, operating facilities such as libraries, IT equipment, and access to academic and personal support. Learn more about tuition fees, funding and student finance.

ADDITIONAL COSTS

All essential safety equipment, other than boots, is provided free of charge by the department.

Find out more about the additional study costs that may apply to this course.

SCHOLARSHIPS AND BURSARIES

We offer a range of scholarships and bursaries to help cover tuition fees and help with living expenses while at university.

Scholarships and bursaries you can apply for from the United Kingdom

Entry requirements

The qualifications and exam results you'll need to apply for this course.

Your qualification	**Requirements** About our typical entry requirements
A levels	ABB Applicants with the Extended Project Qualification (EPQ) are eligible for a reduction in grade requirements. For this course, the offer is **BBB** with **A** in the EPQ. You may automatically qualify for reduced entry requirements through our contextual offers scheme. If you don't meet the entry requirements, you may be able to complete a foundation year which would allow you to progress to this course. Available foundation years: • Engineering Foundation BEng (Hons) (4 year route including a Foundation Year at Carmel College)
GCSE	4/C in English and 4/C in Mathematics

Subject requirements	For applicants from England: For science A Levels that include the separately graded practical endorsement, a Pass is required.

Your qualification	Requirements About our typical entry requirements
BTEC Level 3 Subsidiary Diploma	Distinction in BTEC (any subject) plus AB in A Levels. A Levels must include Mathematics and a science subject (Chemistry, Computer Science, Further Mathematics, Physics or Electronics).
BTEC Level 3 Diploma	D*D in a relevant BTEC considered alongside grade B in A Level Mathematics.
BTEC Level 3 National Extended Diploma	D*D*D in a relevant Diploma, including Distinction in 'Further Mathematics for Engineering Technicians' unit. Students will also be required to take an online Mathematics assessment, please contact the University for further information.
International Baccalaureate	35 overall, including 5 in Higher Level Mathematics and 5 in a Higher Level science subject.
Irish Leaving Certificate	H1, H2, H2, H2, H3, H3 including H2 or above in Mathematics and a science subject (Chemistry, Computer Science, Further Mathematics, Physics or Electronics).
Scottish Higher/Advanced Higher	ABB in Advanced Highers including Mathematics and a science subject (Chemistry, Computer Science, Further Mathematics, Physics or Electronics).
Welsh Baccalaureate Advanced	Accepted at grade B alongside A Level grades AB in Mathematics and a science subject (Chemistry, Computer Science, Further Mathematics, Physics or Electronics).

Cambridge Pre-U Diploma	D3 in Cambridge Pre U Principal Subject is accepted as equivalent to A-Level grade A M2 in Cambridge Pre U Principal Subject is accepted as equivalent to A-Level grade B Global

	Perspectives and Short Courses are not accepted.
Your qualification	**Requirements** About our typical entry requirements Considered if taking a relevant subject. 42 Level 3 credits at Distinction, including 15 Level 3 credits in Mathematics is required. GCSE English and Mathematics grade C/4 or above also required. Students will be required to take an online Mathematics assessment, please contact the University for further information.
Access	
International qualifications	Many countries have a different education system to that of the UK, meaning your qualifications may not meet our direct entry requirements. Although there is no direct Foundation Certificate route to this course, completing a Foundation Certificate, such as that offered by the University of Liverpool International College, can guarantee you a place on a number of similar courses which may interest you.

ALTERNATIVE ENTRY REQUIREMENTS

- If your qualification isn't listed here, or you're taking a combination of qualifications, contact us for advice
- Applications from mature students are welcome.

THE ORIGINAL REDBRICK