

BEng (Hons) in Electronics and Electrical Engineering

Course Specifications

Credit	Lab. Hrs.	Lecture Hrs.	Course Title	Course Code
3	0	3	Engineering Mathematics 1	GSE212
<p>The course consolidates the mathematical skills that underpin the BEng engineering degrees. In particular, it aims to</p> <ul style="list-style-type: none"> To consolidate the student's knowledge and understanding of a broad range of mathematical techniques appropriate for engineering courses. To provide the knowledge and skills that enables the student to use computer software and programming as a support for his/her engineering studies. <p>On completion of the course, students will:</p> <ul style="list-style-type: none"> be able to understand and perform a range of algebraic operations including operations on complex numbers in various forms; be able to differentiate and integrate functions of one real variable using a variety of techniques; understand how calculus is used to model changes in engineering systems; 				
3	0	3	Engineering Mathematics 2	GSE222
<p>The course continues to consolidate the mathematical skill that required for a BEng degree. On completion the course, students will</p> <ul style="list-style-type: none"> be able to sketch the elementary functions; be able to apply quantitative methods and computer software relevant to engineering. be able to sketch piecewise functions and rational functions; understand how calculus is used to model changes in engineering systems including applications involving partial derivatives. 				
3	2	2	Principles of Engineering Science 1	GSE213
<p>The course develops the students' understanding of essential scientific principles for the study of engineering to degree level. It is designed to be accessible to students with a wide range of prior science specialisation. The course comprises two blocks of study. These blocks are common to all engineering disciplines and introduce the principles of measurement systems and units, thermal physics, mechanical and electrical principles, and engineering materials and their properties. On successful completion of this course, students will be able to understand the fundamental principles of:</p> <ul style="list-style-type: none"> Thermal physics including: phase transitions and gas laws; different modes of heat transfer Basic concepts of optics, electricity and electromagnetism 				
3	2	2	Principle of Engineering Science 2	GSE221

The course develops the students' understanding of essential scientific principles for the study of engineering to degree level. It is designed to be accessible to students with a wide range of prior science specialisation. The course comprises two blocks of study. These blocks are common to all engineering disciplines and introduce the principles of measurement systems and units, thermal physics, mechanical and electrical principles, and engineering materials and their properties. On successful completion of this course, students will be able to understand the fundamental principles of:

- How the properties of materials can be used in the design of engineering applications and devices
- How the properties of a material are controlled by its internal structure and how this can be controlled by composition and processing

Students will know and understand more advanced aspects of one of: thermodynamics and fluid mechanics; electrical and electronic systems; fluid mechanics and structural engineering

3	2	2	Engineering Practice and Design 1	GSE210
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The course covers practical work, design activities, sustainable development principles, project management, health and safety and risk management, and transferable skills.

Its overall aim is for students to begin their engagement with engineering design and to undertake practical engineering work.

Part A: *Practical work* - provides skills designing, prototyping and model building, Health and safety, project management and group work.

Part B: *Design and drawing* - provides skills in design and drawing, design methods and constraints, creative thinking and problem solving techniques.

3	2	2	Engineering Practice and Design2	GSE220
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The course builds on Engineering Practice and Design1. In particular, it will cover hand drawing, sketching buildings or large scale engineering artifact. Computer aided drawing, presentation skills and Personal Development planning.

3	2	2	Power Engineering Technology	ElecEng325
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Power Engineering Technology is designed train students to become certified power engineering technologists who can control large, complex power and process systems. The program offers a high-level course of study that trains students to perform production work in the operation and development of large energy projects such as oil sands, gas plants and electrical generating stations.

3	0	3	Circuits, Signals and Systems theory	ElecEng311
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In practical engineering it is very common to assume, at least initially, that the system to be analysed or designed is linear and time-invariant. Linear, time-invariant systems provide potentially good approximations to the behaviour of many systems in their normal operating region. The advantage of linear, time-invariant systems is that they can in general be analysed. Nonlinear systems on the other hand cannot in general be analysed and one is forced to resort to approximate analysis based on simulation. This course offers an introduction to the analysis of linear, time-invariant systems.

<p>Ideally the analysis of a system involves the determination as mathematical functions of time of all of the signals associated with the system. Accordingly it is impossible to provide an analysis procedure for systems without a preliminary discussion of signals. Specifically the course introduces and explains the mathematical ideas which underpin the very important concept of the frequency content of a signal. The course covers the mathematics required to undertake a study of dynamics, communication theory, signal processing, advanced circuit theory, partial differential equations and control theory, with engineering examples. The course also provides advanced techniques for the solution of linear, constant coefficient, ordinary differential equations.</p>				
3	0	3	Instrumentation and Control	ElecEng310
<p>Instrumentation and Control covers a range of topics which are important to the monitoring and control of modern systems. Radio frequency electronics , Integrated digital electronics, Semiconductor engineering , Photonic technology, Dynamics, Vibration, Signals and systems, Systems and control, Signal and pattern processing, Data transmission and Computer and network systems.</p>				
3	0	3	Electrical Machines and drives	ElecEng324
<p>We shall cover: EE220</p> <ul style="list-style-type: none"> • The design of modern electrical drives, with consideration of the machine, power electronics and control requirements. Comparisons are made between drive types and typical application considered. • Magnetic and electric loadings; thermal design; winding design, choice of pole number, phase number, field and armature location. Permanent magnet machines; induction machines; switched reluctance machines; vector control of ac machines; applications characteristic of ac drives; comparative evaluation of different drives. • Use of commercially available software to perform machine analysis and design. 				
3	0	3	Control Engineering	ElecEng421
<p>To develop knowledge of the analysis of linear continuous-time systems. To introduce the basic analysis and design tools for electronic system control engineering.</p>				
3	2	2	Devices	ElecEng322
<p>The course aims to cover:</p> <ul style="list-style-type: none"> • The design of modern electrical drives, with consideration of the machine, power electronics and control requirements. Comparisons are made between drive types and typical application considered. • Magnetic and electric loadings; thermal design; winding design, choice of pole number, phase number, field and armature location. Permanent magnet machines; induction machines; switched reluctance machines; vector control of ac machines; applications characteristic of ac drives; comparative evaluation of different drives. • The use of commercially available software to perform machine analysis and design.EE311 				
3	0	3	Analogue and digital circuit design 1	ElecEng315

<p>This course provides integrated circuit (IC) designers with the knowledge of analogue, mixed signal and digital circuits and also experience with both the practical issues of device-level design and system-level performance requirements.</p> <p>A key feature is the course's balanced approach to both analogue and digital IC design, and its in-depth treatment of high frequency and low power circuits.</p>				
3	2	2	Analogue and digital circuit design 2	ElecEng320
<p>This course follows on from Analogue and Digital circuit 1 which provides integrated circuit (IC) designers with in-depth knowledge of analogue, mixed signal and digital circuits and also experience with both the practical issues of device-level design and system-level performance requirements.</p> <p>A key feature is related to design for test and CAD algorithms and design automation will be covered, as well as robust design methods, which allow relaxation of performance requirements, yield enhancement and exploitation of state-of-the-art process technology.</p>				
3	2	2	Radio Frequency systems 1	ElecEng411
<p>This course covers the design and analysis of radio frequency systems from early design to modern digital systems. Noise measurement, reduction, shielding, grounding and general issues of EMC are covered. RF terminology and wave propagation is explained along with a look at modulation and demodulation techniques and the circuits needed to carry them out.</p> <p>It aims to</p> <ul style="list-style-type: none"> To explain basic radio frequency terms. To explain radio systems. To explain and show how to calculate radio propagation paths. To explain basic antenna systems and show how they can be designed. 				
3	2	2	Radio Frequency systems 2	ElecEng422
<p>The course looks at various transmitter and receiver designs and the principles of the design of aerials . High frequency and transmission lines effects are investigated. The emphasis throughout is on circuit design techniques for RF systems.</p> <p>It aims to</p> <ul style="list-style-type: none"> To explain transmission-line effects and line-matching methods. To explain modulators and their design. To investigate the problems created by noise in radio systems. To explain modulation, demodulation and the performance of demodulators To explain how transmitters and receivers work 				
6	12	0	Design Project	ElecEng423
<p>The Individual Project is a learning experience that enables students to do independent research and bring together many of the concepts they have been learning over the last few years. The work</p>				

calls for careful planning, critical judgment, engineering competence, and communication skills. Further details are provided in the Individual Project Guide for Students. This Guide may be updated from time to time, and include information generally on how to plan the project, and on milestones, important dates, and deliverables.

The aims of this course are therefore:

- To integrate previously learnt and taught knowledge and skills
- To provide an opportunity for students to pursue extended independent research into an aspect of engineering/environmental science in which they may have developed a special interest, and provide experience of the way subject areas actually progress.
- To develop a basic ability to define a research question, plan and execute an investigation to answer that question
- To encourage students to develop a systematic and critical approach to enquiry through the planning, execution and presentation of a piece of work which involves the application of research techniques.
- To develop students' independence, initiative and critical thinking
- To develop a wide range of transferable skills including problem solving, planning and meeting your own deadlines; selecting, gathering, evaluating and synthesizing information from a range of sources; using information and communication technology to acquire, collate, process and analyse data and information implementation; designing and testing skills; preparing, processing, interpreting and presenting data, using appropriate qualitative and quantitative techniques and ICT packages and communicating ideas and arguments effectively in a variety of written formats
- To understand the structure and elements of a research project in preparation for undertaking relevant research at work.

3	0	3	Principles of Control	ElecEng315
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The course is an introduction to the theory and practice of continuous-time feedback control systems to enable the design and implementation of servo tracking systems for linear dynamical systems. It is designed as a core course for the BEng courses. It provides an analytic approach to the modelling of dynamical systems and their analysis by applying engineering mathematics.

The aims are:

1. To enable students to understand the role played by feedback to deal with uncertainty about real physical dynamical systems and to design control systems that are able to follow demands as quickly and with as small an error as possible.
2. To enable students to model a range of dynamical systems from different engineering disciplines and to analytically predict their time and frequency behaviour..
3. To enable students to select appropriate sensors, actuators and instrumentation to implement control systems for a variety of engineering systems.

3	0	3	Signal Processing	ElecEng224
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To introduce the students to the fundamentals of signal processing and provide them with the essential knowledge about the main themes, so that, in the future, the students will be able to readily apply their knowledge in industry or research or further enhance it by self-study.

3	0	3	Optical and Semiconductor Devices	ElecEng214
<ul style="list-style-type: none"> To describe the operation of commercially important semiconductor devices (diodes, BJT, MOSFET) and how these are described by the semiconductor physics. To present the causes of non-constant frequency response in electronic amplifiers. To give an understanding of the non-idealities of real operational amplifiers. To give an understanding of the application and effect of feedback in electronic circuits. To present the various forms of power amplifier in common use. 				
3	0	3	Integrated Circuit Deigns	ElecEng416
To introduce the students to the fundamentals of VLSI design and provide them with the essential knowledge about the main themes, so that, in future, the students will be able to readily apply this knowledge in industry or research or further enhance it by self-study.				
3	0	3	Engineering Management and Economics	GSE329
Introduction to engineering management. Types and characteristics of production systems. Forecasting methods and techniques. Product design. Capacity planning. Aggregate planning. Inventory planning and materials management. Short term scheduling. Quality management and quality control. Job design and work methods. Project planning and scheduling.				
3	0	3	Introduction to Signals and Communications	ElecEng215
<ul style="list-style-type: none"> To ensure students have a broad understanding of the concepts of mobile communication systems. EE310 To ensure students are familiar with quantitative signal measurements required in defining the operation and quality of performance of such systems. To ensure students have a basic working knowledge of Matlab and its application to the above systems and signals. 				
3	0	3	Energy Conversion	ElecEng312
The aim of this course is to introduce students to the fundamentals engineering principles of all major sources of renewable energy, including a detailed understanding of its conversion into electricity and subsequent distribution. Students will gain an overview of the engineering challenges of renewable energy production and a wider understanding of renewable energy in a societal context. The existing and future requirements of the distribution and transmission networks in relation to increased renewable and distributed generation will be covered, including development of the Smart Grid. The leading technologies in the field will be examined in detail, with a focus on electrical machine and power conversion requirements.				
3	0	3	Analysis of Circuits	ElecEng225

<ul style="list-style-type: none"> • To develop the student's understanding of system analysis and controller design using state space techniques. • To introduce linear control system design using computer aid design techniques. • To give the student an understanding of design for test methodologies and to introduce them to the VHDL Language and the design tools based on VHDL. The course covers the following topics: techniques for ATPG, Fault Simulation and Testability Analysis for VLSI circuits; methodologies for designing testable circuits; VHDL Language and design tools based on the VHDL Language. 				
3	0	3	Signals and Linear Systems	ElecEng413
<ul style="list-style-type: none"> • To provide knowledge and understanding of the fundamentals of linear systems theory and its application to the analysis of signals and system behaviour. • To provide understanding of the basic design principles of communication systems. • To enhance understanding of communications concepts and systems. • To enable the student to appreciate the vital role of analogue and digital communications in the modern world. <p>To understand basic concepts of information theory and channel coding.</p>				
3			Internship	ElecEng323
<p>This course provides the students with an opportunity to experience the industrial world and be part of a team working on real world project. The University assists each students to find the most suitable industry.</p>				
3	0	3	Engineering Research Methods	ElecEng415
<p>The aim of this course is to develop the undergraduate's research skill to a postgraduate level, such that the student is equipped to perform a postgraduate technical research project. In addition to develop and enhance their critical thinking abilities which will have a wider use beyond (post-) graduate studies.</p>				
3	0	3	Arabic Language	ARB 101
<p>This course deals with issues related to the Arabic grammar and literature. It studies some basic linguistic issues in the vocabulary, morphology, syntax, and semantics of Arabic. It also studies stylistic and literary features through analyzing and discussing some selected texts from the holy Quran and other literary masterpieces.</p>				
3	0	3	History and Civilization of Bahrain	HBH 105
<p>This course deals with the history of Bahrain from 1500-1800. It studies the stages of the Portuguese invasion of this part of the world and the international power struggle that erupted after the invasion. It also deals with the ruling of Al-Utuub Tribe of Bahrain and the reign of Al Khalifa thereafter.</p>				
3	0	3	Human Rights	HR 106

This course discusses the basic principles of human rights. It acquaints the students with the nature of human rights; their realms and sources, paying special attention to the international legal provisions concerning human rights included in the following documents:

- United Nations Charter.
- International Declaration of Human Rights.
- International Accord on Civil & Political Rights.
- International Accord on Social & Economic Rights.
- International agreement against torture and inhumane, disrespectful punishment.

Protection mechanisms and constitutional organization of public rights and freedoms in the Kingdom of Bahrain.

3	0	3	Intermediate English	ENG111
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ENG 111 is a skill-building course, which enables students to speak with ease and confidence, communicate with different types of people, discuss academic, social and professional matters, listen to news in English, read newspapers, magazines and references, write personal and business letters, write reports and articles, etc.

3	0	3	Advanced English	ENG112
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ENG 112 is a three-credit-hour course that runs for one semester (or term) of 15 weeks. It is the second of two credit English language courses which all incoming students are required to take during their study at the University. The course is skill-building which enables students to speak with ease and confidence, communicate with different types of people, discuss academic, social and professional matters, listen to news in English, watch TV programmes, read newspapers, magazines and references, write personal and business letters, write reports and articles, etc. It fulfills a high level of proficiency in English as a prerequisite for academic, social and professional success.

3	4	1	Practical Electronics	ElecEng128
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- To become proficient in the use of electrical measuring equipment.
- To gain an appreciation of the problems involved in practical circuit design and construction.

3	0	3	Engineering Science 1	GSE114
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This course covers scientific principles of physics and chemistry at a level between secondary school level and Advanced Level. It serves as a preparatory course for students intending to undertake engineering undergraduate degree courses in the University and introduces students to a range of skills required for the study of engineering.

The course aims are:

- To introduce the elementary principles of chemistry and physics, necessary for subsequent studies.
- To develop appropriate skills required in these subject areas, including information skills and examination techniques

3	0	3	Mathematics 1	GSE110
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This course provides a foundation in Mathematics, covering all the topics subsequently used in an Engineering degree.

3	4	1	Laboratory and Workshop Skills	GSE128
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This course is a mixture of workshop exercises and practical experiments and projects. Students work in small groups of 2-5 people depending on the task. The course also provide students with introduction to design skills and basic engineering drawing. It aims to provide students with an appreciation of engineering workshop environment and with skills of taking measurement and collecting data. Students will also learn how to analyse data and presented in a written form. They will also learn how to combine experimental data and practical skills with theoretical knowledge in solving engineering problems.

3	4	1	Advanced Analogue and Digital Techniques 1	ElecEng410
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This course covers the design, analysis and production of integrated circuits. Specialist linear circuit techniques are explored. The case study of a typical monolithic operational amplifier design is used as a vehicle for further analysis of analogue linear methods of ic design.

CAD tools will be used to design and simulate integrated circuits on silicon workspace.

The course also covers further programming methods using HDLs and HLL programming of MCUs

The aims are

- To fully understand the complete process of designing an integrated circuit
- To use CAD tools and appropriate programming languages
- To understand the special design requirements of integrated circuits
- To be conversant with some of the first order and second order effects in i.c. design.

3	4	1	Advanced Analogue and Digital Techniques 2	ElecEng420
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This course covers the design and analysis of modern digital systems utilising finite state machines. Comparison between the use of CPLDs and microcontrollers in typical embedded systems will be made and appropriate hardware and software methods for a successful design will be considered. Synchronous and asynchronous designs will be covered along with a consideration of the principles of 'design for testability' and JTAG technologies.

CAD tools will be used to design and simulate integrated circuits on silicon workspace.

The course also covers further programming methods using HDLs and HLL programming of MCUs

Aims are

- To be familiar with designing circuits using specialist functions.
 - To provide students with knowledge of the design, test and implementation methods used in modern digital systems.
 - To enable students to make decisions concerning the best design and test strategies for the prototyping and mass production of new digital systems.

- To give students the confidence to use CAD tools throughout the design and test process.
- To enable students to utilise programmable embedded devices within complex systems.

3	0	3	Principles of Engineering	GSE114
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This course introduces the elementary principles of physics and chemistry and transferable skills necessary for the study of subsequent units

3	0	3	Mathematics 2	GSE124
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This course aims to provide students with the mathematical knowledge and skills necessary for the rest of the course. The course will emphasise themes which are central to the field of engineering in general.

3	0	3	Engineering Science 2	GSE125
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This course is aimed at extending the science knowledge of engineering students in preparation for continuing on their respective engineering degree. It covers general applied physical principles, including dynamics, statics, fluids, heat and energy. The course aims to prepare students for entry into the BEng degree courses by providing an advanced level of knowledge and understanding of applied physics, and basic mechanical and thermodynamics principles.

3	0	3	Study Skills and Professional Practice	GSE113
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This course provides an introduction to both Study and professional Skills and practice. The course introduces study skills considering both individual and team-working skills, it covers exam preparation, revision and question answering techniques. It introduces students to their own Personal Development Planning processes. It also enables students to develop and use appropriate safe working practices as will be expected in an engineering and industrial environment. It aims to lay the foundation for development of personal and inter-personal learning and communication skills that students will require during their studies. It also aims to provide students with understanding of safety issues and engineering practices and to enable students to develop confidence in their problem solving techniques.

3	0	3	Computer Programming for Engineering	GSE127
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This course introduce students with concepts of programming. This include conditional, alternatives, iterations and block structure. Structure programming and data-types will also be introduced and illustrated on a typical but simple engineering problems.

3	0	3	Engineering Ethics	GSE324
<p>This course introduces the theory and the practice of engineering ethics using a multi-disciplinary and cross-cultural approach. Theory includes ethics and philosophy of engineering. Historical cases are taken primarily from the scholarly literatures on engineering ethics, and hypothetical cases are written by students. Each student will write a story by selecting an ancestor or mythic hero as a substitute for a character in a historical case. Students will compare these cases and recommend action.</p>				

3	0	3	Advanced Engineering Mathematics	ElecEng314
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This course covers advanced undergraduate engineering mathematics. It aims to

- To develop the student's knowledge and understanding of engineering mathematics,
- To provide the student with key skills that are required for the identification, classification and description of the performance of engineering systems through the use of analytical methods.

Upon successful completion of this course, the student should be able to:

- Classify differential equations according to their order, linearity and homogeneity,
- Understand how differential equations are used for modelling engineering systems,
- Know how to apply various numerical methods (for example Newton Raphson and Runge Kutta) to engineering problems.

3	0	3	Principles of Electronics and Electrical Engineering 1	EleEng211
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The material in this course is divided into two blocks Digital, Analogue and Electrical.

Digital part covers the introduction to digital circuits using combinational and sequential logic building blocks to create simple digital system designs.

Analogue part covers an introduction to active devices and their role in creating standard analogue circuit building blocks. These simple building blocks will then be used to create simple analogue system designs

It aims to

1. To develop knowledge, and the ability to analyse and understand the operation of a digital circuit
2. To develop knowledge, and the ability to analyse and understand how active analogue circuits work and how they can be used to create complete electronic systems with known i/o characteristics
3. To develop knowledge, and the ability to analyse and understand the operation of a dc circuit

3	0	3	Principles of Electronics and Electrical Engineering 2	ElecEng221
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This course follows on from Principles of Electronics and Electrical Engineering 1. The material in this course with the third component. Namely Electrical. It covers dc & ac circuit theory and circuit analysis techniques.

It aims to

1. To develop knowledge, and the ability to analyse and understand the operation of an ac circuit
2. To develop practical skills to enable students to have confidence in building and testing circuitry
3. To develop knowledge and skill in using standard workshop instruments.

3	0	3	Innovation, enterprise and Management	ElecEng224
<p>The course emphasizes on the definitions of creativity, innovation and enterprise Consideration of the range of tools and techniques used in organisations to encourage creativity, Characteristics of the innovative organisation, and how to create an appropriate environment for creativity, Consideration of barriers to creativity and how to overcome them and the planning process of a new product/service development within enterprising organisations.</p> <p>On completing the course, student should be able to:</p> <ul style="list-style-type: none"> • Comprehend the role of creativity and innovation in enterprising organisations. • Comprehend the tools and techniques of creative and innovation management. • Examine the barriers to creativity and how successful organisations overcome these challenges. • Evaluate the process of planning from creativity to the implementation of innovation in enterprising organisations - in private, public and the voluntary sectors. 				