Programme Specification

A statement of the knowledge, understanding and skills that underpin a taught programme of study leading to an award from The University of Sheffield

1. Programme Title		2. Programme Code	3. JACS Code
Electrical Engineering		EEEU01	H620
Electronic Engineering		EEEU05	H610
Electronic and Communications Engineering		EEEU13	H640
Electronic and Computer Engineering		EEEU74	H651
4	**Level of Study**	Undergraduate	
5a	**Final Qualification**	Bachelor of Engineering with Honours (BEng Hons)	
5b	**QAA FHEQ Level**	Honours	
6	**Intermediate Qualification(s)**	None	
7	**Teaching Institution** (if not Sheffield)	Not applicable	
8	**Faculty**	Engineering	
9	**Co-ordinating Department**	Electronic and Electrical Engineering	
10	**Other Department(s) involved in teaching the programme**	Core teaching: Applied Mathematics, Automatic Control & Systems Engineering, Management School Options: Modern Languages Teaching Centre	
11	**Mode(s) of Attendance**	Full-time	
12	**Duration of the Programme**	3 years	
13	**Accrediting Professional or Statutory Body**	Institution of Engineering and Technology	
14	**Date of production/revision**	September 2018, Revised December 2019	

15. Background to the programme and subject area

Electronic and electrical engineers are responsible for the design and development of electronic and electrical aids to modern living. The area of Electronic and Electrical Engineering (EEE) is very wide and, after two years of common study, these programmes give students the opportunity to focus on one of the following three areas:-

- **Electrical Engineering:** concerned mainly with the generation, distribution, application and control of electrical energy. Activities range from very large systems such as the national power generation infrastructure to much smaller self-contained systems in automotive, aerospace or marine applications.
- **Electronic Engineering:** concerned primarily with the design of devices, circuits, systems that can acquire, condition and process signals representing physical variables. The basic principles of electronic circuits underlie the whole of electronics.
- **Electronic and Communications Engineering:** concerned with the design of the circuits and systems and components used to create, transmit, receive and process signals used for information transfer in communication and radar systems.
- **Electronic and Computer Engineering** – concerned with the application of computer architectures within electronic systems and with the design of very large scale integrated (VLSI) circuits for digital computing applications.

There is a large overlap between these specialisation areas and for the first two years all three programmes are mainly similar. Indeed, they are identical for U02/06/10/14. U12 differs from the others by 20 credits in year 1 and 40 credits in year 2. In addition to providing a firm foundation in all areas of EEE, this commonality enables students to make an informed choice of specialisation at the end of year 2 (does not apply to Uxx) and widens considerably the range of employment possibilities open to them upon graduation. Although most of the students graduating from the course gain employment in the electrical/electronic engineering industrial sector, some gain employment in other apparently unrelated areas such as banking, chartered accountancy, technical journalism and teaching. A significant number embark on further studies towards MSc, MPhil or PhD degrees.

These programmes are accredited by the Institution of Engineering and Technology as satisfying part of the academic requirements for Chartered Engineer status. The remaining requirements may be satisfied after graduation by undertaking a programme of further study, such as an “approved” MSc, to bring a student’s educational attainment to masters’ level.

Further information about the programmes may be found on the internet at http://www.sheffield.ac.uk/eee/admissions/our_courses

16. Programme Aims

The aims of the programmes are to:

1. provide teaching that is informed and invigorated by the research and scholarship of its staff.
2. enable students to develop a thorough knowledge and understanding of the electrical and electronic science and its engineering applications.
3. provide students with an educational base which will in part satisfy the educational requirements needed to become a Chartered Engineer.
4. give students the opportunity to study particular aspects of electronic and electrical engineering in depth, according to their interests.
5. encourage in students independence of thought and a critical approach to the interpretation of experimental evidence and to the evaluation of existing information.
6. foster in students a commitment to self-improvement and continuing professional development.
7. help students develop a range of generic presentational and interpersonal skills appropriate to employment in the engineering sector and elsewhere.

17. Programme learning outcomes

Knowledge and understanding: By graduation, students will have knowledge and understanding of the:	
K1	fundamental principles of engineering science relevant to electronic and electrical engineering.
K2	mathematics necessary to predict the behaviour of electrical and electronic systems.
K3	analytical and design methods and tools appropriate for electronic and electrical systems.
K4	basic ideas behind interpersonal relationships in a group working context and the legal and ethical responsibilities of a professional engineer.
In addition to K1 to K4, for students on the Electrical Engineering programme:	
K5	requirements, specifications and dynamic operation of electrical and electromechanical engineering systems.
In addition to K1 to K4, for students on the Electronic Engineering programme:	
K6	physical principles of electronic systems applicable to instrumentation, measurement, signal conditioning, system control and component level design.
In addition to K1 to K4, for students on the Electronic and Communications Engineering programme:	
K7	principles of both the information and transmission aspects of a communication system and the relevant analytical and computer based analysis tools.

Skills and other attributes

Intellectual skills: By graduation, students will be able to:	
I1	gather, organise and critically evaluate information needed to formulate and solve problems.
I2	apply acquired knowledge effectively and efficiently in the relevant areas of Engineering.
I3	create imaginative and innovative solutions to unfamiliar problems.
I4	interpret the results of experimental investigations.

Practical skills: By graduation, students will be able to:	
P1	design and execute experiments to investigate device, circuit or system behaviour.
P2	use appropriately computer aids for design and analysis.
P3	prepare technical reports and presentations.
P4	write computer programmes to solve engineering problems.

Transferable skills: By graduation students will be able to:	
T1	write reports and deliver oral presentations in a style appropriate for the audience.
T2	use IT resources effectively.
T3	work independently on a design problem.
T4	work effectively in teams.
T5	plan simple projects and manage time effectively.

18. Teaching, learning and assessment

Development of the learning outcomes is promoted through the following teaching and learning methods:

- **Lectures:** used to transmit information, explain theories and concepts, and illustrate methods of analysis or design. For most lecture courses tutorial sheets are provided to enable students to develop their understanding during private study.
- **Practical classes:** working in groups of two or three, students undertake laboratory experiments and small design projects to gain practical skills. The design projects require students to seek additional information. A second year industrial project, the “SHIPS” project, in which students work on a feasibility study in groups of four to six, is used to give students the chance to practice the team-working methods they have been taught in lectures.
- **Personal tutorials:** run for small groups of six or less to discuss both technical and transferable skill based material. Students are encouraged to take an active part in discussions.
- **Problem classes:** run for the whole class to help students to resolve difficulties as they work through the problem sheets.
- **Individual design project:** a major study carried out over two semesters, involving the creation of a specification from a user requirement followed by the design and construction of a prototype that will meet the specification. It is supervised by a member of the academic staff and allows the student to display initiative, originality and creativity.

Opportunities to demonstrate achievement of the learning outcomes are provided through the following assessment methods:

- **Written examinations -** examinations of two or three hour duration.
- **Coursework submissions** - these include formal laboratory reports, the SHIPS group report, programming assignments and tutorial assignments.
- **Oral presentations** - oral presentation is used as one of the methods of assessment in all three years of the course. In the SHIPS group project, each member of the group is expected to take part in the presentation.
- **Individual project reports** - written reports prepared individually.

The main teaching, learning and assessment methods adopted for each learning outcome are shown below. In most cases a combination of methods is used.

Learning Outcome (in abbreviated form – see section 17 for the full text)	Teaching / Learning						Assessment			
	Lectures	Practical classes	Coursework assignments	Tutorials / example classes	Individual design project		Written examinations	Coursework submissions	Oral presentations	Individual project reports
K1 Fundamental principles	•	•	•	•	•		•	•		•
K2 Mathematical tools	•	•		•	•		•	•		•
K3 Analysis and design	•	•	•	•	•		•	•		•
K4 Professional issues	•		•	•			•	•		
K5 Electrical engineering	•	•		•	•		•			•
K6 Electronic engineering	•	•		•	•		•			•
K7 Electronic and Communications engineering	•	•		•	•		•			•
I1 Critical evaluation		•	•	•	•					•
I2 Application of knowledge		•	•	•	•		•	•		•
I3 Creativity and innovation					•					•
I4 Interpretation of experimental evidence		•			•			•		•
P1 Experimental skills		•			•			•		•
P2 Computer aided design / analysis		•			•			•		•
P3 Technical communication skills	•	•	•	•	•			•	•	•
P4 Computer programming	•		•		•			•		•
T1 Presentation skills	•	•	•	•	•			•	•	•
T2 Use of IT		•	•		•			•		•
T3 Independent working					•				•	•
T4 Teamwork	•	•	•					•	•	
T5 Project / time management	•	•			•					•

Proportions of types of assessment by level can be found on the UniStats website: http://unistats.direct.gov.uk/

19. Reference points

The learning outcomes have been developed to reflect the following points of reference:

Subject Benchmark Statements
http://www.qaa.ac.uk/AssuringStandardsAndQuality/subject-guidance/Pages/Subject-benchmark-statements.aspx

Framework for Higher Education Qualifications (2008)
http://www.qaa.ac.uk/Publications/InformationAndGuidance/Pages/The-framework-for-higher-education-qualifications-in-England-Wales-and-Northern-Ireland.aspx

University Strategic Plan
http://www.sheffield.ac.uk/strategicplan

Learning and Teaching Strategy (2016-21
https://www.sheffield.ac.uk/staff/learning-teaching/our-approach/strategy2016-21

UK-SPEC, Engineering Council, 2013

20. Programme structure and regulations

The structure of these programmes is modular and each year students study modules worth a total of 120 credits. The first two years of all three programmes are common with the EEE MEng programmes. With the benefit of more detailed knowledge of the degree options available, at the end of year 2 students must choose between one of the three BEng programmes detailed here or one of the five associated MEng programmes. A student's initial application in no way constrains this choice, but changes between and within BEng and MEng programmes, and vice versa, are not generally permitted after the beginning of Year 3. Students must satisfy the appropriate progression criteria in order to proceed to Year 3 of an MEng programme; those who do not will be required to remain on their chosen BEng programme.

In Year 3, students study modules biased towards their area of interest, the choice of modules reflecting the particular BEng programme being followed. The Year 3 practical work comprises a major individual design project spread over two semesters.

Detailed information about the structure of programmes, regulations concerning assessment and progression and descriptions of individual modules are published in the University Calendar available on-line at http://www.sheffield.ac.uk/calendar/regs.

21. Student development over the course of study

Year 1 - Students are introduced to the physical concepts, mathematical tools and elementary experimental methods of Electronic, Electrical and Computer Engineering. Professional approaches to the presentation of technical information are introduced. By the end of the year students will be able to apply basic analytical and experimental methods to modest problems and will be able to communicate the results of short experiments and investigations in oral and written form.

Year 2 - New concepts are explained in practically useful contexts to help students develop the art of applying fundamental principles to real and complicated situations. Non-technical second year modules help students to begin to appreciate the professional and ethical responsibilities of an Engineer. The design project in the second year requires students to find things out for themselves and manage their time effectively. Both oral and written presentation skills are further developed and students have their first taste of presenting orally to an audience including external industrial engineers.

Year 3 - Students study a programme biased towards their chosen area of specialisation. The design project is done in the supervisor's laboratories and interacting with research workers develops further the student's approach to personal organisation, time management and problem solving. By the end of the year students will be able to plan and organise projects independently and will have the confidence to apply standard techniques to unfamiliar problems. Students will begin to realise that by creative and imaginative application of their knowledge they can create innovative and original solutions to complicated design problems.

On successful completion of the programme - Students will have obtained academic qualifications forming part of the educational requirement for becoming a Chartered Engineer (CEng) for degree classifications of II.2 or above, or Incorporated Engineer (IEng) for class III degrees. To complete the educational requirements for chartered status, they will need to complete a programme of approved further learning to bring them to Masters level and they must then gain appropriate experience working as a graduate engineer before fully satisfying CEng requirements. They will be well prepared for a career not only in the Engineering sector but also in a wide variety of other areas and may choose to embark on a programme of postgraduate academic or vocational study. Throughout their careers they will be able to assess their continuing professional development needs and take action to satisfy those needs.

22. Criteria for admission to the programme

Detailed information regarding admission to the programme is available at http://www.shef.ac.uk/prospective/

23. Additional information

The first two years of the programmes offered by the EEE department cover an unusually wide range of topics. This differentiates our graduates from those of many other institutions because, whatever their specialisation, they will have a solid foundation across all areas of the subject. This makes our graduates effective in an interdisciplinary environment and makes it possible for them to work in areas different from their degree specialisation. This effectiveness is enhanced further by the Faculty skills weeks that are compulsory interdisciplinary activities for all first and second year students across the Faculty. The aim of these activities is to develop the transferable skills that are valued by employers.

The department has extensive semiconductor clean room facilities, a result of its research excellence in this area, and in both the first and second years of the course, students benefit from these facilities by fabricating simple semiconductor devices as part of the laboratory class schedule. The clean rooms are also used by students undertaking semiconductor device fabrication projects in the later stages of the degree. The Electrical Machines and Drives research group has extensive industrial contacts with automotive, aerospace and power control industries and the first and second year laboratory machine test beds, which use the latest machine and control technology, were donated by one of these contacts. State of the art facilities such as lamination cutting, magnetising rigs for creating unique permanent magnet geometries, computer controlled dynamometers and extensive magnetic circuit and power electronic computer modelling facilities are available to students who take on projects in this area. The Communications research group has wide contact with the aerospace and mobile communications industries and is equipped with state of the art network analysis and antenna test facilities, the latter including anechoic chambers. These facilities are used by second year design project and third year project students undertaking projects in the communications area.

Further information about all three programmes and the department can be found on-line at http://www.shef.ac.uk/eee

This specification represents a concise statement about the main features of the programme and should be considered alongside other sources of information provided by the teaching department(s) and the University. In addition to programme specific information, further information about studying at The University of Sheffield can be accessed via our Student Services web site at http://www.shef.ac.uk/ssid.