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 with an Industrial Placement Year		EEEU50	H623
Electronic Engineering with a Year in Industry		EEEU51	H615
Electronic and Computer Engineering with an Industrial Placement Year		EEEU53	H612
Electronic and Communications Engineering with a Year in Industry		EEEU54	H649
4	**Level of Study**	Undergraduate	
5a	**Final Qualification**	Master of Engineering (MEng)	
5b	**QAA FHEQ Level**	Masters	
6	**Intermediate Qualification(s)**	Bachelor of Engineering with Honours (BEng Hons) (for students transferring their registration in Years 1 or 2 - see separate programme specification)	
7	**Teaching Institution** (if not Sheffield)	Students will spend one year (their 4th year of study) in Industry	
8	**Faculty**	Engineering	
9	**Department**	Electronic and Electrical Engineering	
10	**Other Department(s) involved in teaching the programme**	Core and option teaching: Applied Mathematics, Automatic Control and Systems Engineering, Management School Option teaching: Modern Languages Teaching Centre, Chemical and Biological Engineering, Mechanical Engineering	
11	**Mode(s) of Attendance**	Full-time	
12	**Duration of the Programme**	5 years	
13	**Accrediting Professional or Statutory Body**	Institution of Engineering and Technology	
14	**Date of production/revision**	March 2018, March 2023	

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 five 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 components circuits and systems that can acquire, condition and process signals representing physical variables and code and transmit information in both electronic and optical forms.
- **Electronic and Communications Engineering** – concerned with the design of the circuits and systems 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.

The boundaries between these specialisation areas are not clear cut and for the first two years all five programmes are the same. 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 and widens considerably the range of employment possibilities open to them upon graduation. This preparation for employment is enhanced because students look for an industrial placement for their fourth year of study when they spend at least 38 weeks working in a relevant industrial environment. During this year the students will gain a wide range of skills (technical, non-technical, interpersonal) that will prepare them to work in industry. On their return, students complete their studies in the fifth year. 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.

Accreditation by the Institution of Engineering and Technology as satisfying the academic requirements for membership of the Institution and for Chartered Engineer status will be sought for these programmes.

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 electrical and electronic science and its engineering applications.
3. provide students with the educational base 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:	
K1	the fundamental principles of engineering science relevant to electronic and electrical engineering.
K2	the 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	the principles underlying engineering management, interpersonal interactions in a group working context and the legal and ethical responsibilities of a professional engineer.
K5	the state of the art in five topics of their choice that lie outside their field of specialisation.
In addition to K1 to K5, for students on the Electrical Engineering programme and on the Electrical & Electronic Engineering programme:	
K6	the requirements, specifications and dynamic operation of electrical and electromechanical systems together with the state of the art in the fields of motion control, machine modelling and energy utilisation.
In addition to K1 to K5, for students on the Electronic Engineering programme and on the Electrical & Electronic Engineering programme:	
K7	the physical principles applicable to electronic instrumentation, measurement, signal conditioning, system control and component level design together with the state of the art in high speed device and circuit design and electromagnetic compatibility.
In addition to K1 to K5, for students on the Electronic and Communications Engineering programme:	
K8	the principles of the information and transmission aspects of a communication system and relevant

	manual and computer based analysis tools together with the state of the art in optical communications, antennas and propagation and electromagnetic compatibility.
In addition to K1 to K5, for students on the Digital Electronics programme:	
K9	the methodologies, technologies, trends and principles associated with state of the art digital and programmable system design.
In addition to K1 to K5, for students on the Microelectronics programme:	
K10	the principles of semiconductor physics that underlie device operation and the methods used for the modelling, fabrication and characterisation of state of the art semiconductor devices.

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	use mathematical tools to model and analyse the behaviour of electrical and electronic devices, circuits and systems.
I5	propose lines of investigation to resolve technical questions.
I6	interpret the results of experimental investigations.

Practical skills: By graduation, students will be able to:	
P1	design and execute experiments to investigate component, circuit or system behaviour.
P2	use appropriately computer aids for design and analysis.
P3	prepare technical reports and poster 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 research problem with an unknown solution.
T4	collaborate with others in a major group project.
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 research project - a major study, carried out over two semesters, involving a significant research

component. It is supervised by a member of the academic staff and allows the student to display initiative, originality and creativity.

- Group project - teams of four students tackle a realistic engineering design project usually supplied by industry. The projects develop a wide range of skills, including team-working and presentation skills.
- Placement in industry – students will be expected to fulfil engineering roles within these companies, applying their understanding, planning their time, using and enhancing their practical skills, communicating (verbal and written) with colleagues, and undertaking projects.

Opportunities to demonstrate achievement of the programme 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, programming assignments and tutorial assignments.
- **Oral presentations** - oral presentation is used as one of the methods of assessment in all four years of the course. In group projects, each member of the group is expected to take part in the presentation.
- **Individual and group project reports** - written reports prepared individually (for individual projects) or as a team (for group projects).

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

	Teaching / Learning						Assessment				
Learning Outcome (in abbreviated form – see section 17 for the full text)	Lectures	Practical classes	Coursework assignments	Tutorials / example classes	Individual research project	Group project	Written examinations	Coursework submissions	Oral presentations	Individual project reports	Group project reports
K1 Fundamental principles	•	•	•	•	•		•	•		•	
K2 Mathematical tools	•	•		•	•	•	•	•		•	•
K3 Analysis and design	•	•	•	•	•	•	•	•		•	•
K4 Professional issues	•		•	•			•	•			
K5 Breadth and depth	•						•				
K6 Electrical engineering	•	•		•	•		•			•	
K7 Electronic engineering	•	•		•	•		•			•	
K8 Electronic and communications engineering	•	•		•	•		•			•	
K9 Digital Electronics	•	•	•	•	•		•	•		•	
K10 Microelectronics	•	•		•	•		•			•	
I1 Critical evaluation		•	•	•	•	•				•	•

I2 Application of knowledge		•	•	•	•	•		•	•		•	•
I3 Creativity and innovation					•	•					•	•
I4 Analysis	•	•		•	•	•		•			•	•
I5 Design of investigations		•			•	•			•		•	•
I6 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

Draft Annex to Academic Standards - Engineering: Annex B4 MEng Degrees, Quality Assurance Agency for Higher Education, 2010.

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 five programmes is common with the three EEE BEng 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 five MEng programmes specified here (with our without a year in industry) or one of the three BEng programmes. A student's initial application in no way constrains the choice made at the end of Year 2. Students may change between the MEng programmes run by the Department until the beginning of the spring semester of Year 3 but changes between MEng and BEng are not 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 register for a BEng programme.

In Year 3 students study modules biased towards their area of interest and practical work comprises a 30 credit Individual Project spread across two semesters.

The fourth year is the placement year in industry. Students are responsible for seeking out their own placement (although help will be available from the Department and the Careers Service) and students who fail to find an appropriate placement will be required to re-register for one of the degree programmes without a year in industry). Whilst in industry students will be visited on a number of occasions, will need to produce two reports, keep a log book and provide a presentation on their return to University.

The fifth year of study (corresponding to the fourth year of the main MEng programmes) contains a number of core modules, which are different for each degree specialisation, together with additional modules which can be chosen freely from a large list. The group project forms one quarter of this year's activity and consequently represents an important part of a student's studies.

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 and Electrical 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 begin to study, in depth, in their chosen area of specialisation. The investigative 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 make original contributions to unsolved problems.

Year 4 – Students undertake a placement in Industry of at least 38 weeks. Students will work on real problems, in groups and individually, throughout the year. They will acquire and develop further real skills in an industrial context and learn to use these skills in an industrial/commercial context. They should be able to demonstrate the application of knowledge, understanding and creativity and have developed improved approaches to solving problems. Students will learn to interact with colleagues, communicating the products of their work, improving and enhancing their skills in this area. They should also have developed their interpersonal, time-management, and project-planning skills.

Year 5 - Students will develop a thorough understanding of the state of the art in their specialised area. They will appreciate present day technological limitations and be aware of likely short to medium term developments in their sector. Students will have the confidence and interpersonal skills to fulfil a range of different roles in an interdisciplinary teamwork environment; they will be able to motivate and encourage, criticise constructively and

take criticism in their interactions with other team members. Students will be effective communicators of sophisticated ideas using a variety of media.

On successful completion of the programme - Students will have obtained the necessary academic qualifications for becoming a Chartered Engineer (CEng) although they need more, 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/

Most students enter with A level qualifications in Mathematics, Physics and either a third A level or two AS levels. Students have also entered with BTEC, International Baccalaureate, Scottish Highers and other qualifications.

23. Additional information

The programmes offered by the EEE department cover an unusually wide range of topics in their first two years. This differentiates our graduates from those of some 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 and an outdoor test range at Buxton. These facilities are used by second year design project and third, fourth and fifth year project students undertaking projects in the communications area.

Further information about all 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.