Programme Specification

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

1	**Programme Title**	Computer Systems Engineering
2	**Programme Code**	ELEU001 / ACSU01
3	**HECoS Code**	100162
4	**Level of Study**	Undergraduate
5a	**Final Qualification**	Bachelor of Engineering with Honours (BEng Hons)
5b	**Position in the QAA Framework for Higher Education Qualifications**	H
6a	**Intermediate Qualification(s)**	None
6b	**Position in the QAA Framework for Higher Education Qualifications**	Not applicable
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Engineering
9	**School**	Electrical and Electronic Engineering
10	**Other School(s) involved in teaching the programme**	Computer Science and Management School
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 (IET), Institute of Measurement & Control (Inst MC).
14	**Date of production/revision**	March 2024

15. Background to the programme and subject area

The rapid development of computation as an integral part of real-world systems, including almost all industrial activities and many other non-industrial areas such as government and financial institutions, has created a need for systems engineers who have specialist knowledge in computing systems. Further, Computer Systems Engineering is also the subject of extensive ongoing research, with new advances being made in this field.

The Computer Systems Engineering programme aims to provide the necessary set of knowledge and skills for graduates to embark on successful careers in hardware-embedded computational systems. In addition to generic knowledge and skills in systems engineering, the programme develops additional knowledge and skills in technical aspects of computer science such as programming skills (principally in Python and Java), object-oriented design and computer architecture. Students also have the option of studying application areas such as computer security and forensics.

The programme is taught in collaboration with the School of Computer Science and connects fundamental knowledge from classical engineering disciplines with theories and methods in computer science and computing technology.

Demand for graduates with skills in the Computer Systems discipline is increasing rapidly in both industrial and non-industrial areas because of the growing application of systems principles in planning and decision-taking processes. Therefore, graduates from the Computer Systems Engineering course have a wide range of employment opportunities and excellent career prospects.

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.

16. Programme aims

Programmes offered by the School are designed to fulfil the University's mission to provide high quality education for students from a wide variety of educational and social backgrounds. This is carried out in a research-underpinned environment, with staff working at the frontiers of academic enquiry. The specific aims of the Computer Systems Engineering can be summarised as follows:

l   To provide access to an undergraduate degree course in Computer Systems Engineering for students with a suitable level of academic ability;

2   To provide a degree course that is accredited by professional institutions and provides part of the necessary education base required for students to attain the status of Chartered Engineer following appropriate postgraduate training, further study and/or work experience;

3   To provide a range of alternative modules in the broader area of computer systems engineering, in the later years to cover a diversity of student aspirations, within the constraints imposed by the requirements of course accreditation;

4   To provide students with high quality teaching that is underpinned by the research attainment and scholarship of the staff in the field of computer systems engineering;

5   To prepare students for a professional career in the field of Computer Systems Engineering, including the provision of suitable interpersonal skills;

6   To prepare students for a professional career in the field of Computer Systems Engineering, including the provision of project management, organisational, financial and other management skills;

7   To assess students over a range of generic and subject-specific skills;

8   To provide experience in conducting an individual investigative project.

17. Programme learning outcomes

Knowledge and Understanding:

On successful completion of the programme, students will have knowledge and understanding of the:

K1	fundamental principles of engineering science relevant to broad-based systems engineering.
K2	mathematics necessary to apply engineering science to systems engineering.
K3	analytical and design methods used in systems engineering.
K4	use of information technology for analysis, synthesis and design.
K5	knowledge and understanding of computers and the computational aspects of Systems Engineering.

Intellectual Skills:

On successful completion of the programme, students will be able to:

I1	gather, organise and critically evaluate information needed to formulate and solve problems.
I2	analyse and interpret experimental and other numerical data.
I3	display creativity and innovation in solving unfamiliar problems.
I4	exercise independent thought and judgement demonstrated in an item of individual project work.

Practical Skills:

On successful completion of the programme, students will be able to demonstrate:

P1	skills in oral and written communications appropriate for the presentation of technical information and interaction with specialists in other areas of engineering.
P2	abilities in observation, measurement and the design and conduct of experiments through practical experience in the laboratory.
P3	skills in writing computer programs to perform analysis of engineering problems.
P4	the ability to use commercial computer software for analysis, synthesis and design.

General Transferable Skills:	
On successful completion of the programme, students will be able to:	
T1	demonstrate skills in personal organisation, time management and self-motivation.
T2	work collaboratively with others through the development of team skills.
T3	use IT tools effectively.
T4	the use of creativity and innovation in problem solving.
T5	communicate effectively, orally and in writing.

18. Teaching, learning and assessment

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

Lectures – these are used to deliver factual information on specific topics, explain theories and methods of analysis, synthesis and design.

Practical/Laboratory classes – students are organised into small groups (maximum of 3 per group) and follow prescribed experiments under close supervision in order to gain essential practical skills and to support lecture material.

Coursework assignments – these are individual exercises, often computer-based, in which the student is tasked with conducting a study, producing and evaluating results of the study and submitting a written report describing the work carried out.

Tutorials and problem classes – these are run for the whole class and provide a mechanism for more lecturer/student interaction than would normally be possible in a lecture. One major objective of these classes is to help students with the resolution of problems encountered in lectures and/or tutorial sheets that have been issued by the lecturer.

Individual investigative project – this is a study carried out over the final year of the programme. The project is supervised by a member of academic staff and normally enables the student to display initiative, creativity, attention to detail in the execution of the project. In addition, a project dissertation must be written which the supervisor and another member of staff examine. The student is also required to make an oral presentation at the end of the project.

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

Written examinations – when a module is assessed by written examination, these are unseen, timed assessments.

Coursework assessments – these are written assignments which can contribute in whole or in part towards the assessment of a module. For example, in the case of a laboratory-based module, 100% of the assessment may be via coursework.

Oral Presentations and Interviews – Students conducting the Individual Project are required to meet the second marker after one semester for an interview to discuss progress at an interim stage of the project. Students are also required to make an oral presentation of their project after submission of the dissertation.

Individual Project reports – a formal structured report documenting the project from inception to conclusion and including appropriate references, appendices and suggestions for further study. Both the supervisor and a second marker independently assess the dissertation.

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

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LEARNING OUTCOME (abbreviated - see Section 17 for full text)	TEACHING / LEARNING						ASSESSMENT					
	Lectures	Practical classes	Coursework assignments	Tutorials /examples classes	Individual investigative project	Group Projects / Activities	Written examinations	Coursework submissions	Class tests	Oral presentations / interviews	Individual project reports	Group Projects / Activities
K1 Fundamental principles	*	*	*	*	*		*	*		*	*	
K2 Mathematics	*		*	*			*		*			
K3 Analytical / design methods	*		*	*	*	*	*	*	*	*	*	
K4 Information technology		*	*		*	*		*			*	*
K5 Subject specific knowledge	*	*	*	*		*	*	*	*	*		*
K6 Optional language skills	*		*				*	*		*		
I1 Information gathering	*		*	*		*	*	*				*
I2 Analyse / interpret data	*	*	*	*	*	*		*			*	*
I3 Display creativity / innovation					*	*					*	*
I4 Exercise independent thought			*		*	*		*		*	*	*
P1 Oral and written communication		*	*		*	*	*	*		*	*	*
P2 Practical laboratory experience	*	*						*				
P3 Write computer programs	*	*	*					*	*			
P4 Use commercial software			*		*	*		*			*	*
T1 Personal organisation			*		*	*	*	*			*	*
T2 Collaborate in teams			*			*		*				*
T3 Use of IT tools					*	*		*			*	*
T4 Problem solving				*	*	*		*			*	
T5 Effective communication		*	*		*	*	*	*		*	*	*

19. Reference points

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

Mission Statement of the University of Sheffield, as presented in its Strategic Plan
http://www.sheffield.ac.uk/strategicplan

The Education Strategy of the University of Sheffield.

The appropriate qualification descriptors contained in the QAA Framework for Higher Education Qualifications in England Wales and Northern Ireland – August 2015.

The QAA Subject Benchmark Statement – Engineering, March 2023.

AHEP4, published in the Engineering Council reports: UK-SPEC (2020).

Feedback from Course Accreditation Panels representing the Institution of Engineering and Technology and the Institute of Measurement and Control.

The research interests of School staff and the research strategy of the School of Electronic and Electrical Engineering.

20. Programme structure and regulations

The programme is modular in structure and in each year students study modules worth a total of 120 credits.

Student choice within the programme is constrained by the need to satisfy requirements set by the accrediting bodies for the course. It is therefore not possible to offer the students the opportunity to study completely unrestricted modules. Nevertheless, a number of approved optional modules are provided at level three, allowing students to target their programme of study towards any specific subject interests or any aspirations that they may have for employment in particular areas of Computer Systems Engineering. Students also undertake a project in the final year and are able to select from a range of topics so that their project is focused on their area of interest.

A summary of the core/option split for each year of the programme is given below:

	Proportion of core/option modules (%)		
	Year 1	Year 2	Year 3
Core	100	100	75
Options	0	0	25

In Year 1, students study a combination of modules that provide the fundamentals of systems engineering mathematics, systems modelling and simulation, classical control theory, and fundamental electrical, electronic and computing technologies. In addition, practical skills are covered by laboratory and practical skill and computer system design modules which give hands-on experience of test equipment and hardware/software interfacing. Students also participate in a compulsory week-long 'Global Engineering Challenge'. Based on the Engineers without Borders Challenge (a national competition for engineering undergraduates), this gives all first-year engineering students at the University the opportunity to work together in multi-disciplinary teams to tackle a real-world problem with a global perspective.

In Year 2, students focus on systems and control topics in more depth, including modules on discrete systems, mathematics and data modelling, and control systems analysis and design. In addition, students develop knowledge and skills in computer system applications and computer problem solving, including object-orientated design, computer architecture and programming skills. Students also build the professional skills they will need as engineers through the introduction of Law and Finance principles. Students take part in a compulsory week-long project called 'Engineering – You're Hired'. Working again with students from other engineering disciplines, this project enables them to put their skills in collaborative working into practice to solve a technical case-study. The project encourages development of entrepreneurial problem solving, accomplished communication, and cultural agility.

In Year 3, students will study more advanced systems and control engineering subjects, including intelligent systems, digital signal processing and modern control. Students also have the opportunity to specialise in specific areas of interest via optional modules, including a focus on application areas such as machine learning or computer security and forensics. Students are also exposed to professional skills in project management and human resource management. The final year project allows the students to focus on a specific area of interest, selecting a project area from a range of topics. The project also allows the students to enhance their professional skills in project management, organisational and time management skills, report writing and presentational skills.

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.shef.ac.uk/calendar/

21. Student development over the course of study

Year 1	Students will consolidate their mathematical, scientific and computing knowledge and be introduced to the fundamentals of systems engineering and computer systems. They will apply these skills to solve simple and standard problems in systems and control engineering. They will undertake practical experiments and will be able to present, interpret and evaluate data reliably. They will also participate in design exercises requiring conceptual thinking, logical argument and judgement, and allowing the development of communication skills and teamwork. Students will work in cross-faculty teams to tackle a real-world problem with a global perspective, gaining an understanding of global context, technical competence, and developing a range of professional skills.
Year 2	Students will have more extensive knowledge and deeper understanding of system engineering subjects and start to understand the core areas of computer systems engineering. They will be able to select and apply established methods of analysis to solve more difficult problems. They will undertake more detailed design work and develop skills in computer programming. Students will also develop and apply a range of practical skills and build their professional skills through an understanding of legal and financial matters. Students will further develop their professional skills through the development of skills such as entrepreneurial problem solving, accomplished communication, and cultural agility.
Year 3	Students will develop knowledge of a range of advanced methods of analysis for computer systems engineering problems, including an understanding of applications. They will develop a range of professional skills, including project management, organisational and time management skills, report writing and presentation skills.

22. Criteria for admission to the programme

Detailed information regarding admission to the programme is available at
http://www.sheffield.ac.uk/eee/undergraduate/electrical

23. Additional information

The pastoral care of students is very important. All new students are allocated a **Personal Tutor**, who can offer support on a range of matters including advising on module choices, career decisions and in providing references. The Personal Tutor also provides a mechanism for discussing sensitive matters that the student may wish to bring to the attention of the School in a confidential way.

The University and the Faculty of Engineering place strong emphasis on ensuring our graduates have all the attributes necessary for success in their chosen career. Students are assisted in their self-development and continuing professional development through activities embedded throughout the entire degree, including personal tutorials, the 'Global Engineering Challenge' and the 'Engineering – You're Hired' project, and via various taught modules. Students benefit from wide ranging individual support and guidance to assist them in securing industrial placements (summer vacation placements as well as the year in industry) and jobs. This includes Careers events specifically for final and penultimate year Engineering students, which provide career inspiration and guidance, and enable our students to meet potential employers, and to refine their CVs and understanding of how to succeed in the application process. This reinforces the careers support available throughout the degree from the Student Placement Officer and the University's Careers Service (http://www.shef.ac.uk/careers/students). This support continues after students have graduated. We maintain strong links with our graduates who provide input into our courses and provide practical help to students in preparing for employment.

For further information students are directed to the School web pages at http://www.shef.ac.uk/eee. These contain full information on courses and provide access to student handbooks.

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 School(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 www.shef.ac.uk/ssid.