The University Of Sheffield.

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**	Mechatronic and Robotic Engineering with an Industrial Placement Year
2	**Programme Code**	ELEU005
3	**HECoS Code**	100170
4	**Level of Study**	Undergraduate
5a	**Final Qualification**	Master of Engineering with Honours (MEng Hons)
5b	**QAA FHEQ Level**	Honours
6	**Intermediate Qualification(s)**	Bachelor of Engineering with Honours (BEng Hons)
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**	Mechanical, Aerospace and Civil Engineering and Management School
11	**Mode(s) of Attendance**	Full-time
12	**Duration of the Programme**	5 years
13	**Accrediting Professional or Statutory Body**	Institute of Engineering and Technology (IET), Institute of Measurement and Control (InstMC)
14	**Date of production/revision**	March 2024, March 2026

15. Background to the programme and subject area

Mechatronics refers to “the synergistic integration of mechanical engineering with electronics and intelligent computer control in the design and manufacture of products and processes”. Examples of mechatronic systems include robots, computer-controlled aircraft engines, magnetically-levitated trains, anti-lock braking systems in cars, and self-driving vehicles. In all these examples, computer software has become an integral part of the product itself.

The Mechatronic and Robotic Engineering programme aims to provide the necessary skill set for an engineer to embark on a career in mechatronic systems, with an application focus on robotics. In addition to generic knowledge and skills in systems engineering, the programme develops advanced knowledge and skills in the areas of measurement and instrumentation, actuation, electronics, mechanics and dynamics.

The programme is taught in collaboration with the Schools of Mechanical, Aerospace and Civil Engineering and of Electrical and Electronic Engineering and students benefit from access to resources (staff and equipment) throughout the programme from both of these Schools, and also from Chemical, Materials and Biological Engineering and the Management School. These programmes are accredited by the Institution of Engineering and Technology as satisfying the academic requirements for membership of the Institution and for Chartered Engineer status.

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 Mechatronic and Robotic Engineering programme can be summarised as follows:

1. To provide access to undergraduate degree programmes in Mechatronic and Robotic Engineering for students with a suitable level of academic ability.

2. To provide a degree programme that is accredited by professional institutions and provides all of the necessary education base required for students to attain the status of Chartered Engineer following

appropriate postgraduate training and work experience.

3. To provide a range of alternative modules in the broader area of mechatronic and robotic engineering, in the later years to cover a diversity of student aspirations, within the constraints imposed by the requirements of programme accreditation.

4. To provide a range of advanced specialisation modules, in the area of mechatronic and robotic engineering, in the last year to enable students to gain in-depth understanding on selected topics in mechatronic and robotic engineering.

5. To provide teaching that is underpinned by the research attainment and scholarship of the staff.

6. To prepare students for a professional career in the field of Mechatronics and / or Robotics, including the provision of suitable interpersonal skills.

7. To prepare students for a professional career in the field of Mechatronics and / or Robotics, including the provision of project management, organisational, financial and other management skills.

8. To develop in students a range of generic skills appropriate to employment.

9. To provide experience in undertaking a substantial collaborative group design project.

10. To provide experience in conducting an advanced individual investigative project requiring substantial independent study.

11. To provide students with direct experience of working in an engineering company.

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 mechatronic and robotic aspects of Systems Engineering.
K6	advanced elective topics in mechatronic and robotic engineering.
K7	experience of working as a professional engineer in an industrial environment.

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.
P5	appreciate how an engineering company operates.

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 follow complex problems 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.

Industrial Placement – professional experience gained during an extended work placement within an engineering environment.

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.

Group design project - students are organised into groups) and follow a more open –ended experimental programme in which a design objective is prescribed but the precise mechanism for achieving the design is left for the group to determine.

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 at the end of semester 1 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.

Group design project – written reports compiled by the group undertaking the project on a shared authorship basis.

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

LEARNING OUTCOME (abbreviated - see Section 17 for full text)	TEACHING / LEARNING							ASSESSMENT					
	Lectures	Practical classes	Coursework assignments	Tutorials /examples classes	Industrial Placement	Individual investigative project	Group Design Project	Written examinations	Coursework submissions	Class tests	Oral presentations / interviews	Individual project reports	Group Design Project
K1 Fundamental principles	*	*	*	*		*		*	*		*	*	
K2 Mathematics	*		*	*				*		*			
K3 Analytical / design methods	*		*	*		*	*	*	*	*	*	*	
K4 Information technology		*	*			*	*		*			*	*
K5 Subject specific knowledge	*	*	*	*			*	*	*	*	*		*
K6 Optional language skills	*		*					*	*		*		
K7 Advanced topics	*		*	*		*		*	*			*	
K8 Professional experience				*	*								
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			*			*	*		*			*	*
P5 Appreciate how a company operates					*								
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 Electrical and Electronic 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. 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	Year 4	Year 5
Core	100	100	37	Industrial Placement	62.5
Options	0	0	33		37.5

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 control systems in more depth, including modules on discrete systems, mathematics and data modelling and control systems analysis. In addition, students explore the principles of fundamental engineering mechanics. 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 system engineering subjects, including real-time embedded systems, robotics and biomechatronics. Students also have the opportunity to specialise in specific areas of interest via the optional modules, including a focus on application areas such as renewable energy or electrical energy management. Students are also exposed to professional skills in project management and human resource management. Students undertake a major group design project, testing and developing their modelling, analysis and design skills on an unfamiliar, extensive problem, whilst also allowing them to develop a range of professional skills including collaborative working, communication skills, team working and delivering a solution to time and budgetary constraints. In year 4 students work in an engineering company for a minimum of 38 weeks. Throughout the placement year, students maintain an online skills-based journal, which they use to write a short reflection at the end of the placement on the skills they have developed. No mark is awarded for the placement; students either pass or fail. In Year 5, students will study more advanced application subjects and have the opportunity for greater specialisation through optional modules, for example in machine intelligence, flight dynamics and control or fundamental biomechanics. The final year extended project allows the students to focus in depth 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.sheffield.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 more specific mechatronics / robotics related subjects. 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 students' practical and transferable skills will be further developed. Students will build their professional skills through an understanding of legal and financial matters, and 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 mechatronics / robotics related 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. Students will undertake a group design project, allowing them to apply theoretical approaches to real-world problems and to develop professional skills in collaborative working and communication.

Year 4	Students spend the year in an engineering company. They will work with time and funding constraints on a graduate-level industrial project (or series of projects). Their written reports and oral presentation will allow them to record and reflect on their experiences. They will be able to develop enhanced technical and professional skills, and specialist knowledge, which they can then apply to their studies in the final year.
Year 5	Students will develop knowledge of a range of advanced methods of analysis for mechatronics / robotics related 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. Students will develop a high level of creativity, originality and judgement in their project and module studies.

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.

Students are expected to find their own placement (either in the UK or abroad), although we are able to assist through the many contacts University staff have with industry. We regularly update students on companies with suitable placements. The University has a Student Placement Officer who briefs students in Years 2 and 3 on CV writing, strategies for securing a placement, and the practicalities of placement work. It is expected that students receive a salary for their work; around £14k per annum is the norm. The Year in Industry Tutor and the administrative staff maintain regular contact with the student and the placement provider throughout the year to check that the placement is going well. For all UK- and EU-based placements, a member of academic staff also visits the company.

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.