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**	Architectural Engineering
2	**Programme Code**	CIVU24
3	**JACS Code**	H210
4	**Level of Study**	Undergraduate
5a	**Final Qualification**	Bachelor of Engineering with Honours (BEng Hons)
5b	**QAA FHEQ Level**	Bachelor of Engineering (BEng) = Level 6
6	**Intermediate Qualification(s)**	None
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Engineering
9	**Department**	Civil and Structural Engineering
10	**Other Department(s) involved in teaching the programme**	Core Teaching: ● Architecture ● Urban Studies and Planning ● Mechanical Engineering ● Applied Mathematics ● Materials Science and Engineering ● Electrical and Electronic Engineering ● Management School
11	**Mode(s) of Attendance**	Full-time
12	**Duration of the Programme**	3 years
13	**Accrediting Professional or Statutory Body**	Joint Board of Moderators (JBM) of the Institution of Civil Engineers (ICE), Institution of Structural Engineers (IStructE), Chartered Institution of Highways & Transportation (CIHT) and Institute of Highway Engineers (IHE) http://www.jbm.org.uk/
14	**Date of production/revision**	January 2015, February 2019, October 2022, September 2023

15. Background to the programme and subject area

Architectural engineers are concerned with the efficient and sustainable use of energy in buildings and their immediate infrastructure. There is increasing demand for these engineers who can provide the multi-disciplinary skills required at this interface between engineering and architecture. They design and verify the safety and efficient working of the environmental, electrical, internal transportation and safety systems of buildings and other installations which form the infrastructure essential to modern society. This programme aims to address this need by combining subjects from all of the engineering disciplines associated with buildings and their infrastructure, as well as providing an understanding of architectural thinking and practice. In order to qualify, professional engineers must obtain appropriate academic qualifications, accredited by the relevant professional institutions, and must also obtain sufficient practical experience and training.

The BEng Architectural Engineering programme at Sheffield is designed to inspire and provide students with a holistic view of the technical aspects of building design and to prepare them to address the complex inter-disciplinary nature of the challenges of the 21st century, and to maintain our current status as offering one of the leading undergraduate degrees in this field. By providing a co-ordinated and balanced programme, delivered by staff working in research and staff with industrial experience, the programme integrates core engineering science with practical application, aiming to inspire students and to challenge them to excel academically, whilst preparing them to enter professional practice or research.

The BEng in Civil Engineering fully satisfies the educational base requirements for an Incorporated Engineer and partially satisfies the educational base requirements (requiring appropriate further learning to Master's level) for a Chartered Engineer.

Strengths of this programme stem from the development of a sound technical base in engineering principles and

skills in the first two years, which is built on and complemented by application to increasingly complex problems. In the 3rd year this includes undertaking a challenging design project involving independent and group working and integration of technical, professional and management knowledge in a real-life context. This project also provides opportunity to undertake a major piece of individual investigative project work.

The department has a strong research focus, with students taught by active research academics throughout their programme. The programme also includes significant industrial involvement, with a variety of industry speakers, lectures, industrial tutors for design projects, and site visits.

The department also has strong links with alumni and an Industry Partnership careers event which provides opportunities for graduate jobs, work placements and advice on career opportunities. Graduates from this programme have a very good employability record and many go on to further study in Civil or Structural Engineering.

Further information about both the programme and the Department may be found on the internet at http://www.shef.ac.uk/civil/ug.

16. Programme aims

The overall aims of our BEng Architectural Engineering programme are to prepare students to address the complex, global engineering challenges of the 21st century and to engender a commitment to professional development, life-long learning and social responsibility, thus creating graduates who have the capacity to make a beneficial impact in their chosen career. In doing this, we aim to provide the educational base for a Chartered Civil / Structural / Mechanical Engineer.

The key objectives of this programme are:

1. to provide students with a sound technical foundation in the key areas of Civil and Structural Engineering and Mechanical Engineering.

2. to introduce the multi-disciplinary, global and professional context in which civil and structural engineering projects are developed, enabling students to develop an appreciation of the professional responsibilities of civil, structural and building services engineers to society and the environment.

3. to develop students' ability to produce effective, innovative designs solutions for the benefit of humanity, by taking a holistic approach, integrating engineering principles, subject-specialist knowledge with professional engineering skills and attitudes.

4. engender in students a holistic view of scientific and engineering aspects of building design, preparing students for employment in multidisciplinary teams.

5. for students to develop independence of thought, a critical approach to new information and ability to make rational, evidence-based decisions.

6. for students to develop key engineering and professional skills and attitudes valued by employers, including ability to communicate clearly and effectively in a professional environment and to plan and manage work both independently and as part of a diverse but integrated team.

7. to inspire intellectual curiosity for students to become life-long learners by appreciating the need to adapt and keep up to date with changing knowledge and requirements.

17. Programme learning outcomes

Knowledge and understanding:

On successful completion of the programme, candidates will have developed:

K1	broad knowledge and understanding of fundamental concepts and principles of engineering science relevant to building services engineering, civil and structural engineering.	**Teaching / learning methods & strategies (see section 18)** K1, K2 and K3 are developed through a combination of lectures, tutorials / example classes, practical laboratory classes, small group project work, design classes and coursework assignments mainly in Y1 and Y2, but also extending into Y3 of the course.
K2	broad knowledge and understanding of mathematics necessary to represent physical concepts and apply engineering science to building services, civil and structural engineering.	

K3	broad knowledge and understanding of analytical and design methods used in building services, mechanical engineering, and civil and structural engineering.	K4 is developed mainly through practical classes, design classes and coursework assignments, supported by lectures where relevant. K5 is developed through lectures, group project work, design classes and coursework assignments supported by seminars. This starts in Y1, but is principally developed in Y3. K6 is developed through a combination of lectures, coursework and small group work in Y1 and 2 and the Y3 group design project. K7-K9 are developed through a combination of lectures, tutorials coursework assignments, small group project work and year 3 design work. **Assessment (see section 18)** Knowledge and understanding are assessed through a combination of written examinations / class tests (K1-K3, K6-K9), assessed coursework (K1-K9), laboratory reports (K1, K2), group and individual design project reports (K3, K5-K9), oral presentations and interviews (K1, K3, K5-K9).
K4	knowledge and understanding of use of information and computation technology for analysis, design and management.	
K5	An understanding of the operation of the building services, civil and structural engineering industry, including business practice and project management.	
K6	an understanding of the professional and ethical responsibilities of building services, civil and structural engineers, the global context and impacts of civil engineering projects, and the social, environmental, ethical, economic and commercial considerations and constraints that influence engineering decisions.	
K7	broad knowledge and understanding of sciences and technology underpinning building design.	
K8	an understanding of environmental impact of the energy efficiency and sustainability of building design.	
K9	an understanding of the relationship and interaction of architecture and engineering in building design.	

Skills and other attributes:

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

Intellectual skills:

S1	Use engineering science, mathematics and, where appropriate, information technology to analyse and develop solutions to engineering problems.	**Teaching / learning methods & strategies (see section 18)** Intellectual skills are developed over the course of the 3-year programme through the teaching / learning methods outlined above and in section 18. Analysis and problem-solving skills (S1, S2) are developed through coursework in the form of problem sheets, supported by tutorial / example classes as well as through laboratory classes and small group / design projects. Further design and problem-solving skills (S3, S4, S5) are developed mainly through design classes, individual and group project work and coursework assignments. Experimental and research skills (S2, S6, S7, S8) are developed through coursework activities, practical laboratory analysis and the Y3 group design project, as well as through the individual project. **Assessment (see section 18)** Intellectual skills associated with analysis, problem solving and design are assessed through a combination of written examinations (S1), coursework assignments (S1-S7), lab reports (S2, S7), group and individual project reports and presentations / interviews (S3-S6, S8).
S2	Analyse and interpret experimental and other numerical data.	
S3	Design a system, component, process or structure to meet a need.	
S4	Be creative and innovative in solving unfamiliar problems and developing designs.	
S5	Take an integrated / holistic approach to solving problems and developing designs, applying professional judgement to take into account risks, costs, benefits, safety, reliability, social and environmental impact.	
S6	Integrate and evaluate information and data from a variety of sources, exercising independent thought and judgement, taking a critical approach to new information.	
S7	Undertake health and safety risk assessments and devise safe systems of working.	
S8	Plan and undertake research to investigate a technical / design problem.	

Practical skills:		
S9	conduct safely, practical experiments to investigate engineering behaviour and material properties.	**Teaching / learning methods & strategies (see section 18)** Practical skills are developed over the course of the 3-year programme as outlined above and in section 18. Practical experimental skills, manufacturing, drawing and writing computer programmes (S9-S10) are introduced in Y1 through lectures and undertaking practical laboratory, manufacturing and computer classes, sketching and drawing / design classes. These are developed through coursework submissions and through group project work. These skills are further developed in later years, particularly in laboratory practicals and group project work. Use of computer software, scientific literature and skills in technical communication (S11-14) are introduced through lectures and project work, and developed through application in group projects and coursework assignments. **Assessment (see section 18)** Practical skills are assessed through coursework assignments (S9-S14) ,lab reports (S9), class tests (S11), group and individual project reports and presentations / interviews (S12-S14).
S10	prepare technical sketches and drawings, using hand or computer methods as appropriate.	
S11	write computer programs to perform analysis of engineering problems.	
S12	use commercial computer software for analysis and design.	
S13	use published scientific / engineering literature effectively.	
S14	prepare technical reports and give technical presentations.	

General Transferable Skills:		
S15	Use information technology for communication and presentation.	**Teaching / learning methods & strategies (see section 18)**
S16	Communicate effectively (in writing, orally and through drawings).	General transferable skills are developed over the course of the 3-year programme as outlined above and in section 18.
S17	Collaborate with others in interdisciplinary teams.	
S18	Plan and manage their time and resources efficiently.	Communication and presentation skills (S15, S16) are developed through practice in group project work and feedback on reports, coursework assignments and in individual project work.
S19	Find information and learn independently in familiar and unfamiliar situations, through critical enquiry.	

		Teamworking and planning and management skills (S17-S19) are developed throughout the programme, particularly through group design projects and the Y3 integrated design project. In particular, the interdisciplinary teamworking and project management is introduced in theY1 and Y2 faculty interdisciplinary project weeks.
S20	Review their experience and level of competence and plan further personal / professional development in a wide context throughout their career.	Students are encouraged to reflect on their learning and progress (S20) in individual progress reviews with their personal tutor. Reflection on learning and personal and professional development forms part of the Y1 Skills module and Y3 integrated design project.
		Assessment (see section 18)
		S15 and S16 are assessed through group and individual coursework submissions and project work.
		S17 is assessed within group design projects, in particular, the Y3 group design project.
		S18 and S19 are assessed through the final year individual project, and other group design projects and individual coursework.
		S20 is mainly assessed through the Y3 integrated design project and the final year individual project.

18. Teaching, learning and assessment

Development of the programme 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 programmes tutorial sheets are provided to enable students to develop their understanding during private-study.

- **Practical classes -** students undertake laboratory experiments, surveying and computing to gain practical skills.
- **Coursework assignments -** generally require students to seek additional information and work on their own, or sometimes in small groups, to develop understanding of subject matter.
- **Tutorials and example classes -** run for small groups or a whole class to help students with their understanding and to resolve problems as they work through tutorial sheets.
- **Design classes -** students work to solve design problems related to real engineering situations in order to learn design methods and to practise associated analytical techniques.
- **Individual investigative project –** a major study carried out in the final semester of Y3 and involving a significant research component. It is supervised by a member of the academic staff but allows the student ample scope to display initiative, originality and creativity.
- **Group design projects -** teams, typically of 4 -6 students collaborate to tackle realistic design and field-based engineering projects by working through various design stages from concept and elaboration of design briefs to elements of detailed design. These projects, which increase in complexity over the duration of the course, develop a wide range of skills, including team-working and communication skills as well as further developing technical skills.

Formative feedback is provided in all modules, sometimes through the teaching and learning methods outlined above (e.g. advice in tutorial, example and design classes) and sometimes in the form of written comments or verbal discussion relating to coursework assignments. The feedback is usually given by academic staff and teaching assistants, but also through organised peer- and self-assessment, which are very effective learning methods.

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

- **Written examinations –**typically of 2 or 3 hours' duration.
- **Coursework submissions -** these include design studies, computational assignments, laboratory reports and essays.
- **Class tests -** tests conducted in a lecture theatre or workroom during the main teaching periods to assess progress, as an alternative to more formal assessment methods.
- **Oral presentations and interviews –** most group design projects involve an oral presentation of the proposed design in which each group member plays a part. The audience may include industrial visitors and fellow students. An individual interview with two academic staff is held as part of the assessment of the Individual Investigative Project.
- **Individual project reports –** these include intermediate and final written reports for the Individual Investigative Project and other written reports describing individual work and experience gained in group design projects.
- **Group design project reports –** written reports assembled by teams of students with shared authorship.

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

LEARNING OUTCOME (abbreviated – see Section 17 for full text)	TEACHING / LEARNING							ASSESSMENT					
	Lectures	Practical classes	Coursework assignments	Tutorials /examples classes	Design classes	Individual investigative project	Group design projects	Written examinations	Coursework submissions	Class tests	Oral presentations / interviews	Individual project reports	Group design project reports
K1 Fundamental principles	□	□	□	□		□		□	□		□	□	
K2 Mathematics	□		□	□				□		□			
K3 Analytical / design methods	□		□	□	□		□	□	□	□	□		□
K4 Information technology	□	□	□		□		□		□	□			□
K5 Industry / business	□		□				□		□		□		□
K6 Professional responsibility	□		□				□	□	□	□	□		□
K7 Building science & technology	●		●	●		●		●	●			●	
K8 Environmental Impact	●		●	●				●	●				
K9 Architecture - Engineering	●		●		●	●		●	●		●	●	
S1 Analyse problems	□		□	□	□		□	□	□				□
S2 Analyse / interpret data	□	□	□	□	□	□	□		□			□	□
S3 Design to meet a need	□				□		□						□
S4 Be creative / innovative					□	□	□					□	□
S5 Produce integrated designs					□		□				□		□
S6 Exercise independent judgement			□		□	□	□		□		□	□	□
S7 Carry out risk assessment	□	□	□			□	□		□				□
S8 Plan & perform technical investigation		□				□			□		□	□	
S9 Conduct experiments		□	□						□				
S10 Prepare sketches / drawings		□	□		□		□		□				□
S11 Write computer programs	□	□	□						□	□			
S12 Use commercial software			□				□		□				□
S13 Use published literature	□		□			□	□		□			□	
S14 Communicate technical info			□			□	□		□		□	□	□
S15 Use information technology			□			□	□		□		□	□	□
S16 Communicate effectively			□			□	□	□	□		□	□	□
S17 Collaborate in teams							□						□

S18 Manage time efficiently			□			□	□						□	□
S19 Learn independently			□			□	□			□			□	□
S20 Manage professional development			□				□			□			□	□

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

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.

19. Reference points

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

Subject Benchmark Statements
https://www.qaa.ac.uk/the-quality-code/subject-benchmark-statements/subject-benchmark-statement-engineering

Framework for Higher Education Qualifications (2008)
https://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf

Guidelines for an Accredited MEng Course, Joint Board of Moderators of the Institution of Civil Engineers (ICE), Institution of Structural Engineers (IStructE), Chartered Institution of Highways & Transportation (CIHT) and Institute of Highway Engineers (IHE), 2009.

Guidance Notes on the Academic Content Requirements for a Degree in Building Services Engineering, Chartered Institution of Building Services Engineers 2006.

Academic Accreditation Guidelines for the Institution of Mechanical Engineers 2011.

The Accreditation of Higher Education Programmes, UK SPEC, 2004 (updated 2013) Engineering Council
http://www.engc.org.uk/engcdocuments/internet/Website/UK-SPEC%20third%20edition%20%281%29.pdf

University Vision and Strategic Plan
https://www.sheffield.ac.uk/vision

Education Strategy (2020-27)
https://www.sheffield.ac.uk/vision/our-pillars/education

Education Strategy (2020-2025)
https://staff.sheffield.ac.uk/vision/education

In assessing the learning outcomes, the level of performance, e.g. the extent of knowledge and depth of understanding, will comply with guidance given in the above references.

20. Programme structure and regulations

The programme structure is modular and in each year students study modules worth a total of 120 credits. In Years 1 and 2 the programme comprises mainly 20 credit modules and the curriculum has major components of mathematics and applied science. Architecture, Mechanical Engineering, Urban Studies and Town Planning and Electrical Engineering modules to the value of between 10 and 60 credits are taken in each of Years 1 - 3.

In the third year, the curriculum is broader, and involves consolidation of previous learning and application to real, complex situations. A key feature of the 3rd year is the integrated design project. This is 30 credits worth of group design project starting from an initial brief and requires the students to engage with self-directed teamwork and innovative conceptual thinking skills in a multi-discipline environment. Thirty credits of individual investigative project is also carried out providing students with experience of independent learning and research methods.

In addition to the credit-bearing modules, students undertake two non-credit-bearing, compulsory, cross-faculty engineering group projects. In Year 1, students participate in a week-long “Global Engineering Challenge”. Based on the Engineers without Borders Challenge (a national challenge for engineering undergraduates), students from across the Faculty of Engineering work together in multi-disciplinary teams to tackle a real-world problem with a global perspective. In Year 2, students take part in the week-long project “Engineering: You’re Hired”. Again working with students from other engineering disciplines, this project requires them to apply their technical skills and engineering judgement to develop proposals for a technical industrially relevant problem. Both project weeks enable students to develop a range of professional and technical competences, including awareness of the global context of their decisions, communication skills, cultural agility and enterprising problem solving.

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 will be introduced to the principal civil, structural and mechanical engineering subjects and will be able to apply standard methods to analyse relatively simple problems in these areas. In addition an introduction to Architectural technology will be given including sustainability, and vernacular architecture. They will undertake practical experiments, programming 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.
Year 2	Students will gain more extensive knowledge and deeper understanding of the civil, structural and mechanical engineering subjects and principles including the scientific concepts underpinning building technology with a focus on passive design measures. In addition they will be introduced the core principles of reading, representing, and interpreting the physical organisation of space in cities, and the spatial environment and how they can be analysed. They will be able to select and apply established methods of analysis to solve more difficult problems. They will undertake more detailed design work in which some elements of professional practice are introduced. Students' practical and transferable skills will be further developed.
Year 3	Students will be exposed to the complexities of building services engineering and will also develop practical skills necessary to design buildings in an environmentally sustainable manner. Over the course of the second semester, students have the opportunity to experience the design process by working in inter-disciplinary teams on proposals for the redevelopment of a real brownfield site in Sheffield. The exciting and challenging project involves integrating a wide range of technical engineering design and management issues into development of a scheme from initial site and stakeholder analysis through option identification and evaluation to production of design calculations and scheme design drawings. As well as developing skills in team-working, the project also involves a significant piece of individual research and design. This will enhance students' innovative conceptual thinking skills in a multi-discipline environment, require application and integration of technical, professional and management knowledge, develop skills in creativity, independent research, critical evaluation and judgement.
On graduation, students will be well prepared for a career in building services, civil or structural engineering and a range of other careers. They will also be able to assess whether or not they have the ability, motivation and interest to pursue post-graduate education in building services, civil or structural engineering.	

22. Criteria for admission to the programme

Detailed information regarding admission to programmes is available from the Department's website at http://www.shef.ac.uk/civil/ug**.**

23. Additional information

Every student has a personal tutor who is a member of the academic staff. The personal tutor is available to provide help and advice on all aspects of university life, including career decisions. In addition, Year 1 students see their tutor at a series of structured meetings to discuss personal skills and professional issues.

One of the aims of the programme is to assist students in developing a commitment to self-improvement and continuing professional development. Throughout the programme, students are encouraged to think about and record their skills, producing a portfolio to demonstrate achievement of some of the competences required by the Institution of Civil Engineers for graduates aiming to become Chartered Engineers.

Further information about both the programme and the department can be found on the internet at http://www.sheffield.ac.uk/civil

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 www.shef.ac.uk/ssid