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**	Structural Engineering with Architectural Studies
2	**Programme Code**	CIVU19
3	**JACS Code**	H210
4	**Level of Study**	Undergraduate
5a	**Final Qualification**	Master of Engineering (MEng)
5b	**QAA FHEQ Level**	Masters = Level 7
6a	**Intermediate Qualification**	BEng in Structural Engineering with Architectural Studies for students transferring their registration in Year 2 (see separate programme specification)
6b	**QAA FHEQ Level**	Level 6
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Engineering
9	**Department**	Civil and Structural Engineering
10	**Other Departments involved in teaching the programme**	Core teaching: • Architecture, • Applied Mathematics, • Materials Science and Engineering, • Management School
11	**Mode of Attendance**	Full-time
12	**Duration of the Programme**	4 years (MEng), 3 years (BEng)
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**	March 2015, Revised March 2018

15. Background to the programme and subject area

Structural engineers design and verify the safety of the buildings, bridges and other structures which form infrastructure essential to modern society. As structural engineers often work closely with architects, it is highly desirable that they have a knowledge and understanding of the role of architecture in the design process. 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.

This programme provides an option for students who enrolled on the dually accredited course (MEng Structural Engineering and Architecture) but who, **after their second, third or in their fourth year** have decided not to pursue the RIBA Part 1 accreditation. The MEng in Structural Engineering with Architectural Studies provides the academic qualifications for students wanting to become structural engineers, but also continues a thread of architectural theory in addition to core structural engineering topics. By providing a balanced programme, delivered by staff working at the cutting edge of research and staff with industrial experience, the programme integrates core engineering science and architectural theory with practical application, aiming to inspire students and to challenge them to excel academically whilst preparing them to work in the multi-disciplinary teams found in the construction industry or in research.

The MEng in Structural Engineering with Architectural Studies fully satisfies the educational base requirements 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 multi-disciplinary group working. Groups combine a range of technical, professional and management skills and knowledge to provide an integrated solution to a realistic design problem. The final year consolidates previous learning and

provides opportunity to extend knowledge into specialist areas through an individual research project and by exposing students to cutting-edge, research-led Masters-level teaching and 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 strong employability record with most going on to jobs in Civil or Structural Engineering.

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

16. Programme aims

The overall aims of the MEng Structural Engineering with Architectural Studies programme are to prepare students to address the complex, global civil 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 Engineer.

The objectives of this programme are to:

1. to provide students with a sound technical foundation in the key areas of structural engineering including structures, geotechnics, and architectural theory, as well as a more detailed and critical understanding in selected areas of specialist structural 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 and structural 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. for students to develop independence of thought, a critical approach to new information and ability to make rational, evidence-based decisions.
5. 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.
6. to inspire intellectual curiosity and develop the breadth of vision for students to become life-long learners by appreciating the need to adapt and keep up to date with changing knowledge and requirements.
7. engender in students a holistic view of architectural and engineering aspects of design, preparing students for employment in multidisciplinary teams.

17. Programme learning outcomes

Knowledge and understanding

On successful completion of the programme, candidates for MEng and BEng will have developed:

K1	broad knowledge and understanding of fundamental concepts, principles and theories of engineering science relevant to 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 studios and coursework assignments mainly in Y1 and Y2, but also extending into Y3 and Y4 of the course. 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 and Y4.
K2	broad knowledge and understanding of the mathematics necessary to represent physical concepts and apply engineering science to structural engineering.	
K3	broad knowledge and understanding of analytical and design methods used in structural engineering.	
K4	knowledge and understanding of the use of information and computation technology for analysis, design and management.	

K5	an understanding of the operation of the civil engineering industry, including business practice and project management.	K6 is developed through a combination of lectures, coursework and small group work in Y1 and 2 and the Y3 group design project. K7 is developed through a combination of lectures, coursework and design work in throughout the programme. K8 is developed through a combination of lectures, tutorials/ example classes, practical laboratory classes and small group project work, mainly in Y3 and Y4 of the course. These methods include the major Y3 design project and the individual research project in Y4 of the course. **Assessment (see section 18)** Knowledge and understanding are assessed through a combination of written examinations / class tests (K1-K3, K6, K8), assessed coursework (K1-K8), laboratory reports (K1), group and individual design studio assessments and design reports (K2-K7), oral presentations and interviews (K1,K3, K8).
K6	an understanding of the professional and ethical responsibilities of civil 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 the history and theory of architecture and the design process from an architectural perspective.	
In addition, candidates for MEng will have developed:		
K8	advanced knowledge and understanding in selected areas, particularly in structural engineering	

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 4-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 / design studio, 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 research 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 perform and report a programme of original research to investigate a technical 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 4-year programme as outlined above and in section 18. Practical experimental skills, surveying, drawing and writing computer programmes (S10-S12) are introduced in Y1 through lectures and undertaking practical laboratory, surveying and computer classes, sketching and drawing / design classes. These
S10	Undertake basic surveying activities.	
S11	Prepare technical sketches and drawings, using hand or computer methods as appropriate.	

S12	Write computer programs to perform analysis of engineering problems.	are developed through coursework submissions and through group project work. These skills are further developed in later years, particularly in group project work. Use of computer software, scientific literature and skills in technical communication (S13-15) 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-S15),lab reports (S9), class tests (S13), group and individual project reports and presentations / interviews (S10-S15)
S13	Use commercial computer software for analysis and design.	
S14	Use published scientific / engineering literature effectively.	
S15	Prepare technical reports and give technical presentations.	

General Transferable Skills:

S16	Use information technology for communication and presentation.	**Teaching / learning methods & strategies (see section 18)** General transferable skills are developed over the course of the 4-year programme as outlined above and in section 18. Communication and presentation skills (S16, S17) are developed through practice in group project work and feedback on reports, coursework assignments and in individual project work. Teamworking and planning and management skills (S18, S19) are developed throughout the programme, particularly through group design projects / studio and the Y3 integrated design project. In particular, the interdisciplinary teamworking and project management is introduced in theY1 and Y2 faculty interdisciplinary project weeks. Students are encouraged to reflect on their learning and progress (S21) 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)** S16 and S17 are assessed through group and individual coursework submissions and project work. S18 is assessed within group design projects, in particular, the Y3 group design project. S19 and S20 are assessed through the final year individual project, and other group design projects and individual coursework. S21 is mainly assessed through the Y3 integrated design project and the final year individual project.
S17	Communicate effectively (in writing, orally and through drawings).	
S18	Collaborate with others in interdisciplinary teams.	
S19	Plan and manage their time and resources efficiently.	
S20	Find information and learn independently in familiar and unfamiliar situations, through critical enquiry.	
S21	Review their experience and level of competence and plan further personal / professional development in a wide context throughout their career.	

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 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. Design studio work forms a component of the previous architecture part of the programme, with problem based learning delivered through frequent small group and individual design tutorials and reviews.

- **Individual investigative project –** a major study carried out over two semesters 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 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 learning outcomes are provided through the following assessment methods:

- **Written examinations –**typically of 2 or 3 hours' duration.
- **Coursework submissions -** these include engineering design studies, computational assignments, laboratory reports, essays and architectural design portfolios.
- **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.
- **Engineering design project reports –** written reports assembled by teams of students with shared authorship.
- **Design studio assessment –** makes up a component of the previous architecture part of the programme, generally through submission of a coursework portfolio.

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

	TEACHING / LEARNING							ASSESSMENT					
LEARNING OUTCOME (abbreviated - see Section 17 for full text)	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 operation	•		•				•		•		•		•
K6 Professional & ethical responsibility	•		•				•	•	•	•	•		•
K7 Architectural history, theory & design process	•		•		•		•	•	•		•		
K8 Advanced topics incl. structural 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 Plan and conduct experiments		•	•						•				
S10 Undertake surveying	•	•							•				•
S11 Prepare sketches / drawings		•	•		•		•		•				•
S12 Write computer programs	•	•	•						•	•			
S13 Use commercial software			•				•		•				•
S14 Use published literature	•		•			•	•		•			•	
S15 Communicate technical info			•			•	•		•		•	•	•
S16 Use information technology			•			•	•		•		•	•	•
S17 Communicate effectively			•			•	•	•	•		•	•	•
S18 Collaborate in teams							•						•
S19 Manage time efficiently			•			•	•					•	•
S20 Learn independently			•			•	•		•			•	•
S21 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
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

Guidelines for Accredited MEng Degree Programmes leading to Chartered Engineer, 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
http://www.jbm.org.uk/uploads/JBM111_MEng.pdf

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 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

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 per Level.

The curriculum for Levels 1 and 2 are as shown for the MEng Structural Engineering and Architecture (CIVU12).

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 programme is a full semester (60-credits) of design projects that develop through the design process from initial brief and concepts to detailed design. This major project, which involves self-directed teamwork and requires innovative conceptual thinking skills in a multi-discipline environment, is based on a real site in Sheffield.

The final year includes a 30-credit individual investigative project and a variety of optional Masters-level modules that provide opportunity to extend knowledge into specialist areas by exposing students to cutting-edge, research-led teaching. Architectural history and theory modules to the value of 10-20 credits also form part of the curriculum for Levels 3 and 4.

Optionally, students can study in a European university during the second semester of the fourth year. In order to prepare for this in terms of language skills, they may take a language option in the preceding semester. However, the tuition received in Europe takes the form of project supervision and is given in English.

At the end of the second year (Level 2), students on the Structural Engineering and Architecture programme (CIVU12) who meet requirements for progression on the MEng, but who do not meet the requirements for RIBA part 1 will be required to transfer their registration to this programme (MEng Structural Engineering with Architectural Studies). Students who do not meet specified progression targets for MEng will be required to transfer their registration to BEng Structural Engineering with Architectural Studies (see separate specification). During the 3rd and 4th years, normally no changes of registration are allowed.

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

Level 1 (1st year)	*See programme CIVU12 Structural Engineering and Architecture*
Level 2 (2nd year)	*See programme CIVU12 Structural Engineering and Architecture*
Level 3 (3rd year)	Students will be exposed to advanced methods of analysis for a range of structural engineering problems and will apply these methods in project work. They will also enhance their knowledge and understanding of technical, design, and professional issues and construction and project management. 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 architectural and 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, detailed design drawings and models. This project develops skills in self-directed teamwork and requires innovative conceptual thinking skills in a multi-discipline environment. Students research, apply and integrate technical, professional and management knowledge, develop skills in creativity, independent research and judgement and ability to work with uncertainty, manage risk and adapt to changing environments. Students will develop a further understanding of the historical and theoretical context in which architecture is set.
MEng only	Students enhance their depth and breadth of knowledge and understanding through a range of optional, technically advanced masters-level classes, with exposure to cutting-edge research-led teaching. Students also undertake a major individual investigative project, developing their ability

Level 4 (4th year)	to work independently, and carry out research, critically evaluating information and communicating effectively. On graduation, students will be well prepared for a career in 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 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, first year 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 programmes, students are encouraged to think about and record their skills development, producing a portfolio to demonstrate their range of experience and competences.

Further information about both the programme and the Department of Civil and Structural Engineering can be found on the internet at http://www.sheffield.ac.uk/civil. Further information about the School of Architecture is available at http://www.sheffield.ac.uk/architecture

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.