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**	Materials Science and Engineering with an Industrial Placement Year
2	**Programme Code**	CMBU012
3	**JACS Code**	H190
4	**Level of Study**	Undergraduate
5a	**Final Qualification**	Bachelor of Engineering with Honours (BEng Hons)
5b	**QAA FHEQ Level**	Honours
6	**Intermediate Qualification(s)**	None
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Engineering
9	**Department**	Materials Science and Engineering
10	**Other Department(s) involved in teaching the programme**	School of Mathematics and Statistics, Management School, School of Law
11	**Mode(s) of Attendance**	Full-time
12	**Duration of the Programme**	4 years (including a year in industry)
13	**Accrediting Professional or Statutory Body**	The Engineering Council through the Institute of Materials, Minerals and Mining.
14	**Date of production/revision**	September 2023, March 2026

15. Background to the programme and subject area

Materials science and engineering involves the in-depth study of the production, processing, properties and applications of man-made materials. This study is underpinned by two central themes:

I. the link between structure (from the atomic scale through nano and micro to the macro scale) and chemical, physical and mechanical properties of materials; and,

II. how control of structure through processing can be used to optimise engineering performance.

Graduates in materials science and engineering typically work at the interface between pure science and engineering. They are involved in the development of new materials, or new technologies for making or enhancing the properties of existing materials. To do this they must determine appropriate design criteria for a particular application and consider how materials with the required properties can be synthesised. The strong research base and significant industrial links of the Department of Materials Science and Engineering at Sheffield mean that both the engineering and pure science aspects of the discipline are strongly represented in our programmes. The modules comprising these programmes give students an understanding of these themes for many different materials, with an emphasis on how they are developed in the context of structural and functional applications in both industry and research. Students on these programmes have opportunities to develop language skills by taking not for credit modules offered by the Modern Languages Teaching Centre.

Students on the BEng in Materials Science & Engineering with an Industrial Placement Year spend the third year of the four-year degree working in an engineering company of their choice. This provides them with wide-ranging experiences and opportunities to put their academic studies into context, and to improve their technical and professional skills. It enhances their employment prospects, enabling them to gain direct experience of industry culture, make contacts and strengthen their CV. Students who complete their placement successfully can often fast-track to a permanent role within the same company.

Our BEng programmes provide an effective, widely accepted route into a management role in industry or research. Our graduates have gone on to successful careers throughout the UK and the international community in materials-producing and materials-using industries, as well as in academia or research institutes.

The addition of a year in industry between 2nd and third year within a Materials based industry will significantly enhance student engagement and provides them with wide-ranging experiences and opportunities to put their academic studies into context, and to improve their technical and professional skills. It also enhances their employment prospects, enabling them to gain direct experience of industry culture, make contacts and strengthen their CV. Students who complete their placements successfully may be offered full-time graduate employment with the same company following their final year.

16. Programme aims

The aims of these programmes are to**:**

1. enable students to develop a sound knowledge and understanding of materials science and engineering informed by the research interests of the staff;

2. develop in students an independence of thought and a critical approach to evidence, theories and concepts, particularly in the context of materials science and engineering;

3. develop in students an appreciation of the competitive aspects of materials and their selection;

4. provide an educational base, which, together with appropriate further study, will satisfy the academic requirements of the Engineering Council for a Chartered Engineer working in either the materials producer or user industries;

5. provide the educational base for a professional career in a manufacturing industry or in a research-based institution;

6. develop in students a variety of generic skills appropriate to a wide range of graduate level employment;

7. Expose the student to an industrial materials environment which will enhance their engagement in the subject and improve employability.

17. Programme learning outcomes

Knowledge and understanding: On successful completion of these programmes, students will have knowledge and understanding of the**:**	
K1	science and engineering of materials from the perspective of both materials producer and user industries.
K2	thermodynamic and kinetic factors that control a material's microstructure, including phase equilibria, diffusion and reaction kinetics.
K3	structure of materials from the atomic to the macro scale, and how these structures affect properties.
K4	factors that affect the key properties of structural or functional components and how these components are used in real applications.
K5	techniques of structural characterisation, including their possible applications, the interpretation of results and potential sources of error.
K6	technologies used during the production and processing of a range of materials and their surfaces.
K7	mathematics necessary to describe the underlying scientific principles of materials production and behaviour in use, and which forms the basis of modelling.
K8	materials selection and the relative merits of different materials.
K9	experience of practicing as a professional engineer in an industrial environment.
K10	an appreciation of the application of taught engineering skill and their relationship to the workplace through a placement for 1yr within industry.

Skills and other attributes

Intellectual skills: On successful completion of these programmes, students will be able to**:**	
I1	acquire, critically evaluate and use information relating to the properties, processing and use of materials, gathered from a range of sources and presented in various formats.
I2	identify and solve problems within the context of science and engineering.

I3	design and execute experiments in materials processing, property measurement and structural characterisation using a wide range of measuring equipment.
I4	analyse and interpret experimental and other numerical data with an awareness of sources of error and statistical accuracy.
I5	design and organise a substantial piece of individual research.

Practical skills: On successful completion of these programmes, students will be able to**:**	
P1	conduct practical experiments.
P2	effectively convey essential aspects of materials or metal science and engineering via high quality oral, written, numerical, graphical and visual presentations.
P3	produce some materials on a laboratory scale.
P4	Use specific research equipment effectively as part of a substantial item of individual research.

Transferable skills: On successful completion of these programmes, students will be able to**:**	
T1	use information technology for data collection, analysis and the preparation of documents and presentations.
T2	develop and present written, numerical, graphical and visual information effectively.
T3	work individually, collaboratively and in a team.
T4	work to deadlines.
T5	find information and learn independently.
T6	appreciate the way in which an engineering company operates.

18. Teaching, learning and assessment

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

The following are the main teaching and learning methods used**:**

Lectures – the principal formal means of imparting knowledge. Most lecturers provide lecture notes with suggested further reading. Many hand out problem sheets with worked examples to enable students to develop their understanding of the subject matter by independent study. Some sheets are marked and returned to the student; in other cases feedback is provided through discussion in subsequent lectures.

Practical classes – structured laboratory sessions enable students to develop their understanding of experimental design, methods and data interpretation. They provide good opportunities for developing team-working and communication skills, as well as skills in working individually.

Coursework assignments – provide students with opportunities to develop and demonstrate their understanding of the academic content of a module, and their skills in obtaining, using, analysing, interpreting and presenting information. They involve both individual and small group work.

Tutorials/examples classes – may be small group or up to class sized sessions, and are usually led by an academic staff member, who follows a structured programme of exercises. The classes provide students with the opportunity to resolve problems in their understanding of a module's subject matter to practise the application of theoretical concepts, and to integrate the subject matter from different courses.

Individual Industrial Placement: Year 3 is spent in industry. This provides students with experience of working in an engineering company, consolidates the knowledge gained during their academic studies in Years 1 and 2, and enhances their understanding of how to apply this in practice.

Group research project – undertaken in Year 4, by groups of two to five students. It requires students to utilise their academic knowledge and understanding of materials industries, and their communication, teamwork, and problem-solving skills, to tackle a small industrial problem. An additional group report is made in Level 3 where the students analyse a materials industry system.

Individual research project – undertaken in year 4 under the supervision of an academic staff member (or members) andis the final and largest individual project on their programme. The written report, oral presentation, and the student's commitment and progress are all assessed bearing in mind the depth of understanding, the analytical and practical skills, and the knowledge of the subject demonstrated. The final written report and oral presentation (given as a poster) are expected to be to a high standard.

Independent study (not included in the table on page 5) – vital for the successful completion of these programmes. Students are expected to develop this essential skill from Level 1.

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, laboratory reports, oral presentations – these are used to assess a variety of practical and transferable skills as well as the understanding of a module.

Class tests – these are short tests conducted during the main teaching periods to assess on-going progress and understanding.

Individual Industrial Placement: A variety of methods are used to assess the placement undertaken in Year 3. The student must write two reports and a reflection on skills developed during the placement (which the student records in an on-line skills-based journal during the year in industry), and give a presentation to academic staff at the end of the placement.

Group project report – undertaken in Level 2, this project based on the analysis of a chosen artefact is assessed by a written group report and presentation.

Individual project report – this is undertaken in Level 4 and is the final and largest individual project on either programmes. The written report, oral presentation, and the student's commitment and progress are all assessed bearing in mind the depth of understanding, the analytical and practical skills, and the knowledge of the subject demonstrated. The final written report and oral presentation (given to a panel of staff and 4th year students) are expected to be to a high standard.

This combination of assessment enables achievement of all the learning outcomes outlined in Section 17 to be demonstrated over the duration of these programmes.

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 details)	TEACHING/LEARNING								ASSESSMENT							
	Lectures	Practical classes	Coursework assignments	Tutorials/examples classes	Industrial seminars/visits	Group research project	Individual research project	Industrial experience	Written examinations	Coursework submissions	Laboratory reports	Oral presentations	Class tests	Group project reports	Individual project reports	Individual reports/skills-journal
K1 Producer/user perspectives	.		.	.	.				.	.				.		
K2 Thermodynamics/kinetics	.	.	.	.					.	.	.		.			
K3 Structure	.	.	.	.					.	.	.		.			
K4 Key properties	.	.	.	.	.	.	.		.	.	.			.	.	
K5 Characterisation techniques	.	.	.	.			.		.	.	.	.	.		.	
K6 Technologies	.	.	.	.	.				.	.	.					
K7 Mathematics	.			.					.				.			
K8 Materials selection	.	.	.	.	.	.	(·)		.	.	.	.		.	(·)	
K9 industrial experience				.				.								
K10 workplace application of skills				.				.								

I1 Use/evaluate information		.	.	.		.	.		.	.	.	.		.	.	
I2 Identify/solve problems	.	.	.	.		.	.		.	.	.	.	.	.	.	
I3 Design/execute experiments		.				.	.				.	.		.	.	
I4 Analyse/interpret data	.	.	.	.		.	.		.	.	.	.	.	.	.	
I5 Plan research programme			.			.	.			.		.			.	
P1 Conduct experiments		.				.	.				.	.			.	
P2 Convey information effectively		.	.	.		.	.		.	.	.	.		.	.	
P3 Produce materials		.			.		.				.	.			.	
P4 Use research tools		.				.	.			.		.		.	.	
G1 Use IT effectively	.	.	.			.	.			.		.		.	.	
G2 Communicate effectively			.	.		.	.		.	.	.	.		.	.	
G3 Work individually/in teams		.	.			.	.			.		.		.	.	
G4 Work to deadlines			.	.		.	.		.	.		.		.	.	
G5 Learn independently			.			.	.		.	.		.		.	.	
G6 Appreciation of Industry				.												.

The year in industry is assessed on a pass/fail basis. It does not contribute toward the degree classification.

19. Reference points

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

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

Framework for Higher Education Qualifications (2014)
https://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf

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

The requirements of the Engineering Council, and as used by the Institute of Materials, Minerals and Mining for the accreditation of degree programmes intended for potential Chartered Engineers.

20. Programme structure and regulations

The structure of the programme in Materials Science and Engineering is modular. In each level students study modules worth a total of 120 credits.

In **Levels 1 and 2**, the curriculum emphasis is on introducing the theories and concepts underpinning the selection, production, processing and use of materials. The programmes comprise mainly 10 credit and 20 credit modules. Individual courses have associated problem classes, tutorials and practicals. Students enrolled for both the materials and the specialised programmes may also take language in Level 1 as non-credit bearing modules and in level 2 options to the value of 20 credits per year.

In Year 3 students work in an engineering company for a minimum of 38 weeks. Throughout the placement year, students maintain an on-line 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. During years 1 and 2 students may transfer their registration to study for a three year MATU05 BEng in Materials Science & Engineering or to the MEng subject to attaining pass mark (60%). During year 3 students not meeting specified progression criteria for the Year in Industry will be required to transfer to the MATU05 BEng Materials Science & Engineering.

In **Level 4**, there is an emphasis in the curriculum on both group project work and a 30-credit individual research project. The modules taken in the final year provide a systematic and quantitative understanding of the competitive aspects of materials and their selection, as well as some specialist knowledge and

understanding of a range of materials. The mark awarded in the final degree is based on the results obtained at **Levels 2 and 4** weighted in the ratio 1:2. The first two years of this programme and that of the MEng programmes in Materials Science and Engineering or associated specialisms' is common. Students registered for a BEng degree can therefore subsequently change their registration to one of the MEng degree programmes in materials or a specialism if good progress is being made **at the end of Level 2**.
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

Level 1	Students will be introduced to the underlying concepts in materials science and engineering, namely**:** structure from atomic to macro scales; thermodynamics and kinetics; electrical magnetic and optical behaviour; mechanical properties of materials; aspects of materials selection, applications and properties. Practical sessions, demonstrations, works visits, tutorials, and worked examples classes will illustrate these principles and promote skills in measurement, evaluation and interpretation of qualitative and quantitative data for a range of materials. Students will be able to develop and present lines of argument and make sound judgements in accordance with these basic concepts. The course contents have been designed to ensure that all students reach a common level of understanding in Mathematics, Physics and Chemistry even if they do not start with a strong background in one of these areas.
Level 2	Students will build on the materials concepts learned in the first year and continue to expand their mathematical, practical, analytical and presentation skills via lectures, worked examples classes, tutorials and practicals. Materials characterisation will be introduced as a new theme and the links between structure, processing and properties will be developed. Materials selection principles will be extended using the concepts of reverse engineering. Students will develop the ability to apply key concepts and skills in other contexts but will also have an understanding of the limits of their knowledge and how this influences analyses and interpretations based on that knowledge.
Level 3	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, oral presentation and placement-journal 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 apply to their studies in the final year.
Level 4	Students will continue to develop a systematic and quantitative approach to materials science and engineering. This will include acquisition of coherent and detailed knowledge concerning processing, structure and properties for various materials, at least some of which is at, or informed by, the forefront of the discipline. New themes for study will include interfaces and materials in combination such as composites. Students will undertake extended project work. Students' conceptual understanding will enable them to devise and sustain arguments and/or solve problems. They should appreciate the uncertainty, ambiguity and limits of knowledge and be able increasingly to manage their own learning using relevant literature and other media. They will employ their increasing skills and knowledge to undertake an individual research project, so demonstrating that they can**:** carry out independent, original research; critically evaluate their own and others' results; and propose new hypotheses.
On successful completion of the programmes in Materials Science and Engineering: Students will have obtained much of the necessary academic understanding to become a Chartered Engineer in materials. Full Chartered Engineer status will require appropriate additional experience working as a graduate engineer and the completion of some further academic training as specified by the appropriate engineering institute. Students will be well prepared for a career in materials engineering, either in research and development or in production, as well as a wide range of other graduate careers. They will be able to assess whether they have the need, ability, motivation and interest to pursue postgraduate training in materials science and engineering.	

22. Criteria for admission to the programme

Applicants should have a strong background in two of Maths, Physics and Chemistry in GCE A levels or equivalent, with some knowledge, at least to GCSE level, of the third. A wide range of alternative qualifications is listed in the On-Line prospectus. The Materials Science and Engineering with a Foundation Level programme (MATU99) can provide a possible entry point to these programmes for students without this scientific background.

Students must also satisfy the general University matriculation requirements, including an acceptable English language qualification such as a minimum of grade C/4; IELTS grade of 6.5 with a minimum of 6.0 in each component; or an alternative acceptable English language qualification.

Detailed information regarding admission to the programme is available at http://www.shef.ac.uk/study

23. Additional information

Students on this programme may have opportunities to study abroad in either Europe or the US for one or two semesters in their second year.

Our close industrial ties facilitate compulsory industrial visits in Level 1 and joint final year projects. Our industrial visits form part of a Skills Week in Semester 1 of Year 1 that is also designed to demonstrate possible career directions and to develop transferable skills such as group project work and IT. Small bursaries may be available for industry-sponsored final year projects.

Students are encouraged to spend at least one vacation working in industry. Some help is offered in finding placements.

Further details can be found on the Department's website, at**:** http**:**//www.shef.ac.uk/materials/.

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.