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**	Nanomaterials and Materials Science
2	**Programme Code**	CMBT015
3	**JACS Code**	F200
4	**Level of Study**	Postgraduate
5a	**Final Qualification**	MSc
5b	**QAA FHEQ Level**	F7
6a	**Intermediate Qualification(s)**	Postgraduate Diploma (PGDip); Postgraduate Certificate (PGCert)
6b	**QAA FHEQ Level**	F7
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Engineering
9	**Department**	Materials Science and Engineering
10	**Other Departments involved in teaching the programme**	Not applicable
11	**Mode(s) of Attendance**	Full time
12	**Duration of the Programme**	1 year
13	**Accrediting Professional or Statutory Body**	Not applicable
14	**Date of production/revision**	March 2021, March 2026

15. Background to the programme and subject area

Nanomaterials is a modern discipline at the cross-over of materials science and generic nanotechnology, encompassing aspects of chemistry, physics, biology and engineering. Nanomaterials are distinct. It would not be possible to achieve nanomaterials synthesis and understand nanomaterials properties just by scaling down corresponding macro-materials. A discontinuous change of properties is observed, which makes such nano-objects highly interesting and novel study objects. Generally, nanomaterials are defined as having structures at a dimension of <100nm, such as free-standing nanoparticles, or nanograins in a polycrystal or nanoscale inclusion/phase. Applications of nanomaterials have now clearly proven to be industrially relevant and production has reached the level of tonnes. Examples comprise sun-screen cosmetics, using special nanoparticle UV absorption properties, or surface treatments (hardness, durability, self-cleaning, water-repellent), enhancement of fuel combustion efficiency, or materials for novel display screens and radiation sources (e.g. carbon nanotube based).

The **Nanomaterials and Materials Science** programme has the specific aim of combining nanomaterials knowledge with general materials knowledge (which are often unnecessarily separated), enabling students to achieve a distinct qualification that will appeal to a broad employer market. The mechanical, magnetic, optical and functional properties of nanomaterials will be linked to their prospective applications as novel devices engineered at the nanoscale.

16. Programme aims

The aims of the programme are to:

1. provide an advanced course in materials science suitable for graduate students from a range of backgrounds and disciplines.

2. provide students with in-depth understanding, practical knowledge and training in a fundamental area of materials science, ranging from processing, through characterisation, microstructure and properties, to behaviour and applications.

3. give students up-to-date training in the nanomaterials field within nanotechnology and to provide students with a clearly distinct and advanced qualification in a field located at the convergence of standard subjects, such as physics, chemistry, materials or engineering, which should increase the employment opportunities open to them.

4. provide students with an opportunity to undertake and report upon a selected, advanced practical or modelling project in a topical area of materials science (MSc only).

5. equip students with the experience and knowledge to make distinctive contributions in future careers in materials science whether in industry (small and large) or academia.

6. improve and augment the existing transferable skills of students, especially in areas of data acquisition and handling, literature searching, report writing and oral presentational skills.

7. qualify students in the language and classifications used in the nanotechnology area, so that they are able to continue self-study and follow reports ranging from press coverage to the published scientific literature.

17. Programme learning outcomes

Knowledge and understanding:	
Candidates for MSc, PG Dip and PG Cert will gain:	
K1	a sound knowledge and understanding of the important principles that underpin the design, processing microstructure, properties, behaviour and applications of materials, especially nanomaterials.
K2	familiarity with essential primary and secondary source materials appropriate to the programme of study.
In addition, candidates for MSc or PG Dip will gain:	
K3	a sound knowledge and understanding in selected specialist areas of materials science, mainly including nanomaterials.
In addition, candidates for the MSc will gain:	
K4	a detailed knowledge and critical understanding in a current and topical area of research in materials science and nanomaterials.

Skills and other attributes:	
Intellectual skills On successful completion of the programmes, candidates for the MSc, PG diploma and PG Cert will be able to**:**	
I1	select appropriate materials for design purposes based on an understanding of their production and performance.
I2	assimilate information from a variety of sources, and précis it in reports, both written and oral.
I3	manipulate and critically evaluate experimental data acquired through practical work.
I4	be resourceful, think analytically and construct and sustain logical argument in both oral and written forms.
In addition candidates for the MSc will be able to:	
I5	design experiments that achieve the desired outcomes in optimum fashion.

Practical skills	
On successful completion of the programmes, candidates for the MSc, PG Dip and PG Cert will be able to**:**	
P1	produce or process materials for research on a laboratory scale.
P2	characterise the performance of materials by measuring relevant properties.
In addition candidates for the MSc will be able to:	
P3	design and execute an original research project.

Transferable skills	
On successful completion of the programmes, candidates for the MSc, PG Dip and PG Cert will be able to**:**	
T1	report the results of practical work in a coherent and easily assimilated manner, both orally and in writing.
T2	use word processing, spreadsheet and presentation software and a range of appropriate packages to a high standard.
T3	carry out individual directed and self-directed study, and participate effectively in group activities such as seminars and workshops.
T4	find information and learn independently.
In addition candidates for the MSc will be able to:	
T5	prepare an extended written dissertation, to a deadline, based upon an original research project.

18. Teaching, learning and assessment

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

1. **Induction procedures** in the first few weeks of the programme are designed to familiarise students with the important facilities and services within the University. These procedures include an introduction to a variety of information resources, and to departmental stores, workshop and laboratory facilities. Valuable information is available also through the relevant departmental web pages and in the Student Handbook for the programme.

2. Traditional **lectures** are used to impart essential knowledge relating to K1 - K3 above.

3. **Practical Module:** One module early in the academic year will exclusively be used to teach Practical, Modelling and Digital Skills. Most modules comprise course work such as problem sheet assignments, to give students earlier feedback before final exams.

4. **Tutorials** will be offered on two levels, including class room tutorials about overarching topics in nanotechnology as well as practical information about assessment methods, essay writing, and conduct/unfair means, complemented by open hour sessions (individual tutoring) by academic staff. Items 3 and 4 will be used to address individual learning needs and allow discussion of individual problems. They particularly address skills I1, T3 and I4 but include elements also of T2.

5. The individual **research project** is viewed as a very important contributor to the learning outcomes of the MSc programme, contributing to all elements of knowledge and understanding, K1-K4, and to all skills, I1-5, P1-3, T1-5. Each project is carried out under the guidance of at least one supervisor.

6. **Independent study** is essential to the successful completion of the programme. New students are introduced to study skills during the induction procedures and these are reinforced through seminar, workshop, tutorial and practical assignments. Such study is vital to the proper attainment of all the knowledge, understanding and skills outcomes. Students are positively encouraged to undertake independent study, and are given feedback on the results of this study, particularly through seminars, workshops and tutorials, but also by supervisors during practical classes and (for students on the MSc programme) during the extended research project.

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

LEARNING OUTCOME (abbreviated – see Section 17 for full text)		ASSESSMENT										
	Lectures	Practical classes	Coursework assignments	Tutorials/examples classes	Industrial seminars/visits	Individual research project		Written examinations	Coursework submissions	Laboratory reports	Oral presentations	Individual project report
K1 Materials principles	·	·	·	·	·	·		·	·	(·)	·	·
K2 Source materials	·		·	·		·		·	·		·	·
K3 Key topics	·	·	·	·	·			·	·	·		
K4 Research area	·		·	·	·	·		·	·		·	·
I1 Find information			·	·		·		·	·		·	·
I2 Assimilate and précis			·	·		·		·	·		·	·
I3 Analyse/interpret data		·				·				·	·	·
I4 Think analytically	·	·	·	·	·	·		·	·	·	·	·
I5 Design experiments			·			·				·		·
P1 Produce materials		·				·				·	·	(·)
P2 Characterise materials		·	·	·		·		·	·	·	·	(·)
P3 Undertake individual research		·				·				·	·	·
T1 Communicate effectively		·	·	·		·		·	·	·	·	·
T2 Use IT effectively		·	·	·		·			·	·	·	·
T3 Work individually/in teams		·	·	·		·			·	·	·	·
T4 Learn independently	·		·	·		·		·	·	·	·	·
T5 Manage projects/time		·		·		·		·	·	·	·	·

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
https://www.sheffield.ac.uk/vision

Learning and Teaching Strategy (2016-21)
https://www.sheffield.ac.uk/polopoly_fs/1.661828!/file/FinalStrategy.pdf

The research interests of the academic staff and the research strategies of the Department of Materials Science and Engineering

20. Programme structure and regulations

The MSc in Nanomaterials and Materials science consists of eight taught modules which contribute 120 credits to the programme. MSc students undertake an extended research project (MAT6040) principally during the Summer but with a start earlier in the academic year. The project contributes a further 60 credits, making 180 credits for the overall programme.

Students registered for the PG Dip are offered the same combination of taught modules (120 credits) but do not undertake a research project.

Students registered for PG Cert take a combination of taught modules worth a minimum total of 60 credits.

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

The modules taken in the Autumn Semester provide the basic knowledge required for the course and are designed to provide a bridge between existing knowledge possessed by the student and that required by those graduating from the programme. These modules also include training in practical aspects of metallurgy covering aspects of manufacturing, microstructure, properties and applications. Built into the first semester are many opportunities to improve on transferable skills, including language skills for overseas students. All autumn semester modules total 60 credits and success in these is essential to ensure that you are prepared to undertake the more specialised modules in the Spring semester. There is a possible exit point at this stage with the award of PG Cert (requires 60 credits).

In the Spring Semester four 15 credit modules are offered on selected specialist topics focusing on nanomaterials, and functional materials, one of these 15 credit modules is an option choice out of a set of eligible options. Students registered for the MSc will undertake a research project (MAT6040) in a selected area or topic, principally during the Summer period. The choice, which requires appropriate consultation with members of staff contributing to the course, is made early in the Autumn Semester so that 1) skills development activities can be related to the project and 2) you can undertake any necessary preliminary work. To graduate with MSc, students are required to pass also this project which contributes a further 60 credits to the programme, making 180 in total.

22. Criteria for admission to the programme

Detailed information regarding admission to programmes is available from the University's On-Line Prospectus at http://www.shef.ac.uk/courses/.

Detailed information regarding admission to postgraduate programmes is available in the University's On-Line Prospectus at www.shef.ac.uk/postgraduate/

23. Additional information

For further information, students are directed to the Department of Materials Science and Engineering web site 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.