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**	Mechanical Manufacture (Top Up)
2	**Programme Code**	AMRU15 (Apprenticeship)
3	**JACS Code**	H300 / HECOS 100209
4	**Level of Study**	Undergraduate
5a	**Final Qualification**	BEng
5b	**FHEQ Level**	6
6	**Intermediate Qualifications**	None
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Engineering
9	**Department**	AMRC
10	**Other Departments involved in teaching the programme**	Not applicable
11	**Mode of Attendance**	Full-time
12	**Duration of the Programme**	12 months
13	**Accrediting Professional or Statutory Body**	IMechE, IET (both to be sought)
14	**Date of production/revision**	Revision September 2021

15. Background to the programme and subject area

The Top up Degree in Mechanical Manufacture will be offered to students (via their employers) as the development phase technical knowledge element of a degree apprenticeship (as the follow on qualification from the Foundation Degree or Higher National Diploma). Degree apprenticeships offer an apprentice the opportunity to combine working while studying for a work-based academic or vocational high-level qualification.

These apprenticeships include the achievement of academic and vocational qualifications and learning from Level 4 upwards. Degree apprenticeships:

- are the latest model to be developed as part of degree apprenticeship standards, with apprentices achieving a full bachelor's or master's degree as a core component of the apprenticeship.
- combine both higher and vocational education and fully test both the wider occupational competence and academic learning, either using a fully-integrated degree co-designed by employers and Higher Education Institutions, or using a degree plus separate end test of professional competence.

This programme has been developed with employers and with reference to the Apprentice Standards which are developed by employer groups (known as 'trailblazers') and approved by Government.

It has been designed as a progression route for students completing the Foundation Degree in Mechanical Manufacture (in work in local engineering and manufacturing firms), or students with a Higher National Diploma, and aims to provide the specialist knowledge and skills to complement the professional competence that the apprentices will be required to demonstrate.

Students on the programme will be working in a variety of organisations from power systems providers; stainless steel and specialist alloy materials producers; manufacturers of mechanical products, components and magnets, as well as engineering design consultancies. Students will be working for original equipment manufacturers and the many companies along their supply chains.

The programme will provide a general engineering education focusing on materials, their properties and the processes that these materials will undergo during manufacture. It will apply the principles of engineering, physics and materials science to the design, analysis and resolution of engineering problems examining the manufacturing processes through which raw materials are transformed into final products.

The foundation degree (a pre-requisite), prepares students for the top up degree by focusing on the

fundamentals of engineering science, maths for engineers, manufacturing processes and materials, design and CAD CAM and professional engineering practice and operations management. In the second year of the foundation degree students will have completed further maths and computing for engineers, control and automation, mechanics for manufacturing, thermodynamics and fluid mechanics for manufacturing, multidisciplinary design and professional responsibility and sustainable manufacturing.

From this foundation, students will be ready for the top up degree which includes design of composites; advanced and modern materials; lubrication and wear; machine element design and analysis of failure; FEA for machine analysis and an industrial project with project management which will be a work-based project (as apprentices the students are in employment) to enable students to apply their knowledge to their own organisation and for employers to realise a return on their investment.

Student will continue to develop the range of skills, knowledge and practical application needed to work towards Incorporated Engineer registration within a range of engineering contexts.

In addition to the vocational emphasis of the programme, students will also benefit from the AMRC's research activity, which informs its teaching. The AMRC lecturers are active researchers solving real-life industrial problems in a variety of disciplines from design, tooling, factory layouts and manufacturing systems, machining and material selection. Their knowledge is up-to-date and includes relevant, current case studies.

16. Programme aims

The University's Mission is to educate others and ourselves and to learn through doing so, as a civic institution proud of its urban character, driving growth and vibrancy for the city, the region, and the globe. Our vision is research, teaching and learning together create a positive culture of higher education.

The AMRC implements this through a strong commitment to local industry, with a large number of employers both within Sheffield and the region working with the AMRC to address the engineering skills gap by training and educating Advanced, Higher and Degree Apprentices. It has a strong commitment to both teaching and research and works to create and stimulate a commitment to self-learning and development in its students.

The aims of the top up degree are to:

1. provide access to a bachelor's degree in mechanical manufacture to degree apprentices from a range of academic, social and employer backgrounds;
2. produce Mechanical Manufacture engineering graduates who are equipped with the technical and scientific knowledge, understanding and skills appropriate to graduate roles in their organisations, developing students within their professional working career;
3. develop in students an independence of thought, intellectual curiosity and critical approach to evidence, theories and concepts and their application;
4. develop in students a range of subject specific and generic skills appropriate to their employment;
5. develop in students the social, commercial and ethical awareness for a professional engineer;
6. enabling students to maximise their potential throughout the programme;
7. assess a range of student skills, identify and support academic excellence and their application to work-based situations;
8. develop interpersonal, problem solving and transferable skills appropriate to an engineer;
9. develop students' appreciation of the wider engineering context, including the social, business and commercial considerations necessary for a professional engineer;
10. engender attitudes and provide skills which will promote lifelong learning;
11. prepare students for Incorporated Engineer status, post-graduate work and their career in mechanical manufacture.

17. Programme learning outcomes

Science and Mathematics (SM)	
SM1i	Knowledge and understanding of the scientific principles underpinning relevant technologies, and their evolution
SM2i	Knowledge and understanding of mathematics and an awareness of statistical methods necessary to support application of key engineering principles
Engineering Analysis (EA)	
EA1i	Ability to monitor, interpret and apply the results of analysis and modelling in order to bring about continuous improvement
EA2i	Ability to apply quantitative methods in order to understand the performance of systems and components
EA3i	Ability to use the results of engineering analysis to solve engineering problems and to recommend appropriate action
EA4i	Ability to apply an integrated or systems approach to engineering problems through know-how of the relevant technologies and their application
Design (D)	
D1i	Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics
D2i	Define the problem identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards
D3	Work with information that may be incomplete or uncertain and be aware that this may affect the design
D4i	Apply problem-solving skills, technical knowledge and understanding to create or adapt designs solutions that are fit for purpose including operation, maintenance, reliability etc
D5i	Manage the design process, including cost drivers, and evaluate outcomes
D6	Communicate their work to technical and non-technical audiences
Economic, Legal, Social, Ethical and Environmental Context (EL)	
EL1	Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct
EL2	Knowledge and understanding of the commercial, economic and social context of engineering processes
EL3i	Knowledge of management techniques that may be used to achieve engineering objectives
EL4i	Understanding of the requirement for engineering activities to promote sustainable development
EL5	Awareness of the relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues
EL6i	Awareness of risk issues, including health & safety, environmental and commercial risk
Engineering Practice (P)	
P1i	Knowledge of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc.)
P2i	Understanding of and ability to use relevant materials, equipment, tools, processes, or products
P3i	Knowledge and understanding of workshop and laboratory practice

P4i	Ability to use and apply information from technical literature
P6i	Ability to use appropriate codes of practice and industry standards
P7	Awareness of quality issues and their application to continuous improvement
P11i	Awareness of team roles and the ability to work as a member of an engineering team
Additional General Skills (G)	
G1	Apply their skills in problem solving, communication, information retrieval, working with others, and the effective use of general IT facilities
G2	Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
G3i	Plan and carry out a personal programme of work
G4i	Exercise personal responsibility, which may be as a team member

18. Teaching, learning and assessment

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

Students will be trained on practical skills at the AMRC Training Centre including machining and tooling, material handling and health and safety, which will support the practical learning outcomes throughout the course.

All of the students taking this course of study will be in full time employment with an engineering employer. The professional skills developed during the students' employment, e.g. operation of manufacturing processes, professional conduct and social responsibility, report writing, team work and communication are expected to support many of the learning outcomes assessed through the course. Where specific opportunities arise for students to develop their learning based on their employment, job related skills will be embedded into the module design. Where students are working in the areas of industry which are studied in the course, students will be actively encouraged to contribute knowledge and experience from their employment to enrich group learning, for example by bringing videos, examples of products or practical engineering projects.

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

The blended learning pedagogical model will be adopted where appropriate, with instructional content provided for independent study time so that contact time can be used for exercises, problem cases and discussion.

Independent study is relevant to all modules and is intended to be used by students to watch pre-recorded lectures, with quizzes, available on-line through computers, laptops and tablets; read chapters from nominated textbooks and other material; prepare for contact time i.e. tutorials, problem classes, seminars; and develop coursework to improve the understanding of presented topics during the classes.

Lectures (whether during contact time or recorded) are the principal means of imparting knowledge. They will be pre-recorded for independent study or captured by My Echo and made available on-line through computers, laptops and tablets.

Tutorials will be used to briefly and formatively assess independent study (the instructional content from lecture captures, case study examples and reading material). The main aim of tutorials is to explore topics in more detail either through structured discussion or case studies.

Problem solving classes will provide time for students to identify specific and problems, difficulties and solutions, to develop their confidence and competence in problem solving. Students will also be given more complex problems to solve in small groups or individually, with lecturer support.

Laboratory classes provide opportunities for students to practice and develop a range of discipline-based techniques; apply and investigate theoretical and conceptual knowledge; develop experimental techniques and approaches, analysing, interpreting and presenting their findings and data; developing personal and transferable skills such as problem solving, team working, following protocols and working safely.

In addition to planned teaching and learning activities, students are also expected to learn through the preparation of coursework assignments and other assessment activities which generally require students to seek additional information and work on their own, or in small groups, to develop understanding of the subject matter.

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

Knowledge and understanding are primarily assessed through written examinations and coursework, which includes oral presentations and written reports.

Written examinations – unseen examinations.

Coursework submission – designed to test knowledge and communication skills; these include design studies, computing assignments, and laboratory reports.

Oral presentations – these take the form of individual oral presentations or group presentations in which each group member plays a part.

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

Advanced manufacturing engineering apprenticeships
https://www.gov.uk/guidance/advanced-manufacturing-engineering-apprenticeships

Degree apprenticeship standards and frameworks
http://semta.org.uk/careers/higher-apprenticeships

20. Programme structure and regulations

The programme structure is modular with a total of 120 credits. The programme runs for 12 months to allow adequate time for the students to scope a relevant work-based project within their own organisation.

Student will study the fundamental science and mathematics relevant to mechanical manufacture in the preceding foundation degree.

The top up degree will continue the engineering practice, mechanical science and manufacturing materials threads in the design of composites; advanced and modern materials; lubrication and wear; machine element design and analysis of failure; finite element analysis for machines; and a 40 credit industrial project with project management which will be work-based in the student's own organisation.

Students will graduate with a BEng degree in Mechanical Manufacture. Graduates may then take an MSc or equivalent in suitable subjects to meet the full educational requirements for CEng, giving additional flexibility and choice of career options.

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 3	The top up degree will continue the engineering practice, mechanical science and manufacturing materials threads in the design of composites; advanced and modern materials; ; lubrication and wear; machine element design and analysis of failure; finite element analysis for machines; and a 40 credit industrial project with project management which will be work-based in the student's own organisation. Students will develop more extensive specialist knowledge of the principal areas of mechanical manufacture.

22. Criteria for admission to the programme

A pass in the Foundation Degree in Mechanical Manufacture, or equivalent qualification, or relevant Higher National Diploma qualification.

23. Additional information

Further information is available at https://amrctraining.co.uk/apprenticeships/degree-apprenticeships-level-6