



love the journey

Curriculum Implementation 2025-26

Secondary

LCA Strand	Maths
Subject	Engineering
Key Stage	Key Stage 5 (Chapter 12-13)

What are the key concepts taught?	The Level 3 BTEC Engineering curriculum develops a broad and applied understanding of engineering principles, processes and professional practice. Key concepts include: Core Engineering Principles – Mechanical principles, electrical and electronic principles, engineering mathematics and materials science. Engineering Processes & Skills – Health and safety in the engineering workplace, engineering design processes, drawing and CAD skills, manufacturing methods, and quality control. Applied Engineering Disciplines – Mechanical systems, electrical/electronic circuits, fluid power systems, computer-aided design, and engineering project management. Practical and Professional Skills – All students complete the mandatory internally assessed units, which include practical investigations, applied design work, CAD modelling, manufacturing tasks, data analysis and the externally assessed synoptic units.
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What is the sequencing of units?	The curriculum is taught over Chapter 12 and Chapter 13 by three specialists from a science, maths and DT background. This allows pupils to learn complementary engineering concepts concurrently and deepen their understanding of how mechanical, electrical and design principles interconnect in real industrial contexts. <u>Chapter 12 – Foundation Engineering Concepts & Core Skills</u> Pupils begin with Engineering Principles, covering mechanical systems, forces, stress/strain, energy, power transmission, materials behaviour and mathematical modelling. This builds
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	directly on GCSE science and maths, while introducing learners to industry-standard engineering analysis. We then move to Electrical and Electronic Principles, where pupils deepen their understanding of voltage, current, resistance, power, circuit design, measurement and fault-finding. This provides the essential foundation for later power systems and control engineering content. During the year pupils will also study Health & Safety in the Engineering Environment, learning to conduct risk assessments, use tools/equipment safely and understand legislation. These skills underpin all subsequent practical work. Pupils also complete the Engineering Design unit where they learn the design cycle, produce engineering drawings, develop CAD skills, analyse design requirements and create initial prototypes. Within the Materials and Manufacturing unit, exploring material properties, selection processes, machining, forming techniques and quality control. Once core units are complete, pupils complete retrieval and low-stakes assessments and are introduced to Chapter 13 content to support rapid progress in the following year. <u>Chapter 13 – Advanced Engineering Application & Synoptic Integration</u> In Chapter 13, pupils move on to more advanced, industry-relevant engineering concepts to prepare them for external assessment and for higher education or apprenticeships. Pupils complete Mechanical Systems and Industrial Applications, applying prior learning to real engineering contexts including rotary systems, gearing, dynamics, fluid power and structural assessments. This is followed by Electrical Machines and Control Engineering, which introduces motors, generators, sensors, control systems and programmable logic. Engineering Project Management, requiring pupils to plan, manage and evaluate a technical engineering project, integrating health and safety, design documentation, costing and quality assurance. Pupils also complete Advanced CAD and Computer Aided Manufacturing, producing complex 3D models, assemblies, detailed drawings and CNC preparation files. This extends the Chapter 12 CAD foundations. Next, we complete the Synoptic Assessment Preparation Unit, where pupils revisit mathematical modelling, problem-solving, engineering reasoning and data analysis. The year concludes with workshop completion tasks, assessments, and intensive revision of engineering mathematics, report writing and technical accuracy required for both internal and external assessment.
How do we encourage pupils to see the links between different units and concepts?	Engineering naturally requires integration across mechanics, electronics, materials, design and safety. Teachers continually make these links explicit, for example:

	• When designing a mechanical component in CAD, pupils must apply materials knowledge, stress calculations and safety standards. • When building a circuit, pupils apply mathematics, design principles and diagnostic methods learned earlier. • Project management units require pupils to combine design, manufacturing, safety, costings and communication skills. The curriculum deliberately spirals: • Mechanical principles in Chapter 12 underpin advanced mechanical systems in Chapter 13. • CAD skills in Chapter 12 support advanced modelling, assemblies and technical drawings in Chapter 13. • Electrical principles progress to complex systems, control devices and fault diagnosis. Retrieval tasks, questioning and interleaving across engineering sub-disciplines ensure pupils internalise connections between all areas of engineering.
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What are the planned opportunities for adaptive teaching, including for SEND, the more and able and disadvantaged pupils?	Engineering can present significant challenges for disadvantaged and SEND pupils nationally. Our curriculum mitigates this through: • Scaffolded practical tasks and gradual release modelling • Pre-teaching key mathematical concepts • Targeted support in CAD and written technical reporting • Use of differentiated worksheets, practical demonstrations and dual-coded examples • Formal and informal interventions both in and outside lessons • Strong use of technician support during workshop tasks • Adaptations made in line with individual pupil profiles Stretch and challenge opportunities include extended design projects, industry-standard CAD assignments, engineering competitions and guidance for applications to apprenticeships or STEM degrees.
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What are the planned opportunities for retrieval and reflection by pupils?	We use: • Regular low-stakes quizzes revisiting prior engineering principles • Retrieval starters focusing on mechanics, electronics and materials • Cumulative assessments across units • Post-unit reflections where pupils identify strengths and development areas
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	• Independent review tasks requiring pupils to revise or redo calculations, designs or reports • Application tasks using unfamiliar engineering scenarios (e.g. alternative components, new manufacturing constraints) Retrieval continues to increase in complexity as learners approach external assessments.
What are the opportunities for feed forward by the teacher post assessment outcomes?	• Lessons dedicated to reviewing assessments and correcting misconceptions • Targeted “skills-based” tasks (e.g. recalculating tolerances, redesigning a weaker component, or correcting circuit analysis errors) • LCT and PP assessments • Teachers adapting future lessons to revisit identified gaps
What are the planned opportunities for developing Reading?	• Engineering reading lists, including technical articles, industry publications and STEM career resources • Use of extended extracts from engineering standards, technical manuals and design briefs • Reading comprehension tasks in safety, materials and control systems units • Research assignments requiring learners to explore manufacturing methods, industrial applications and engineering regulations • Explicit teaching of how to reference technical sources and patents
What are the planned opportunities for developing literacy, numeracy, oracy and SMSC?	Literacy • Emphasis on Tier 2/3 engineering vocabulary • Structured technical reports, design justifications and project documentation • Extended written evaluation of prototypes, materials and manufacturing processes Numeracy • Embedded engineering mathematics in every unit: algebra, trigonometry, forces, tolerances, power calculations, ratios, statistics and estimation • Repeated practice of formula manipulation and data interpretation • Explicit links to machining calculations, electrical equations and mechanical analysis Oracy

	• Paired and group problem-solving • Verbal design critiques and engineering presentations • Communication during workshop tasks and project meetings SMSC • Exploration of engineering ethics, environmental impact and sustainability • Careers discussions linked to STEM pathways, apprenticeships and industry roles • Study of diverse engineers and global engineering innovations • Understanding risk, safety and the societal purpose of engineering
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